THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXV. No. 1672.] LONDON, MAY 28, 1895. [47TH YEAR. PRICE 6d.

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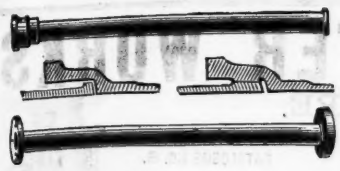

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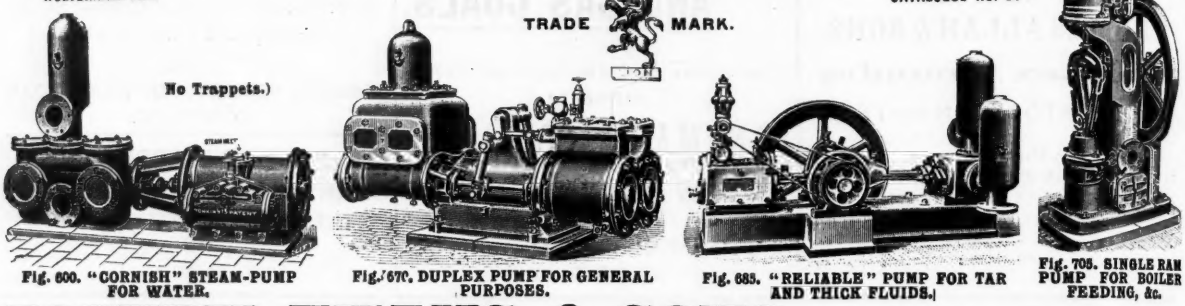

No Trappets.)

Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

Fig. 705. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

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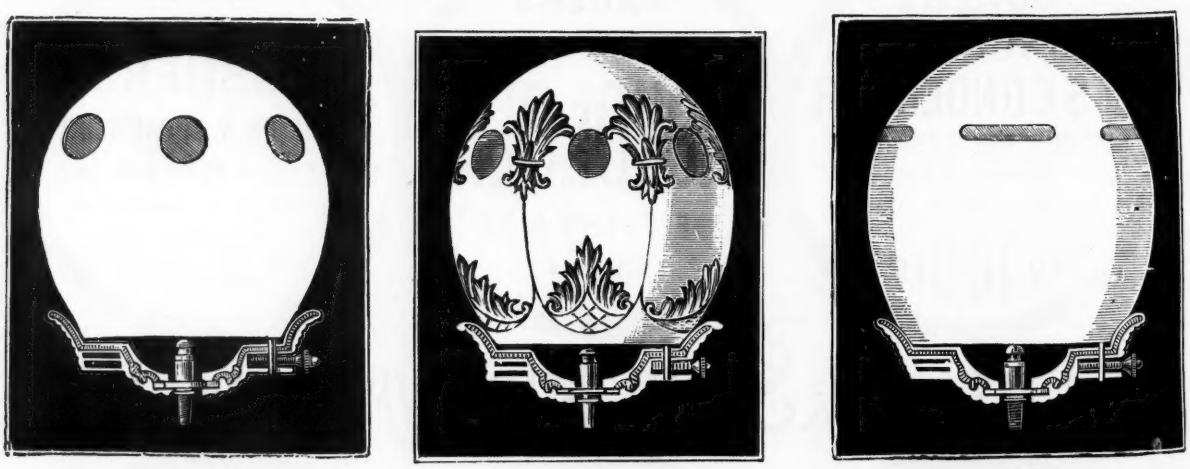

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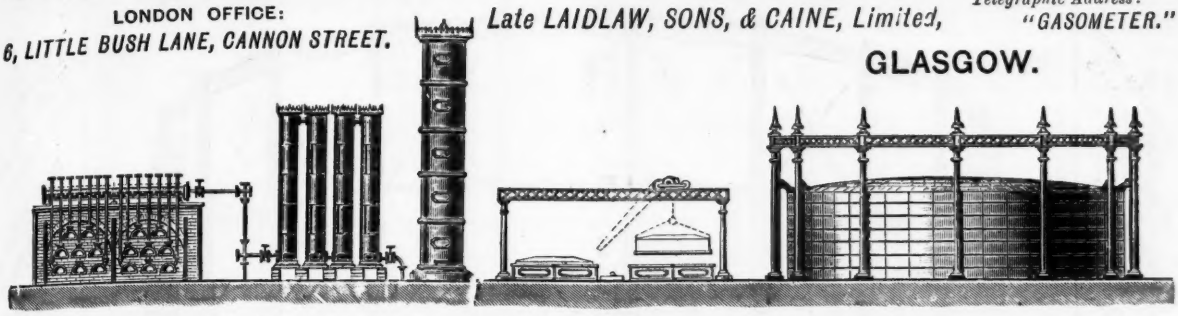

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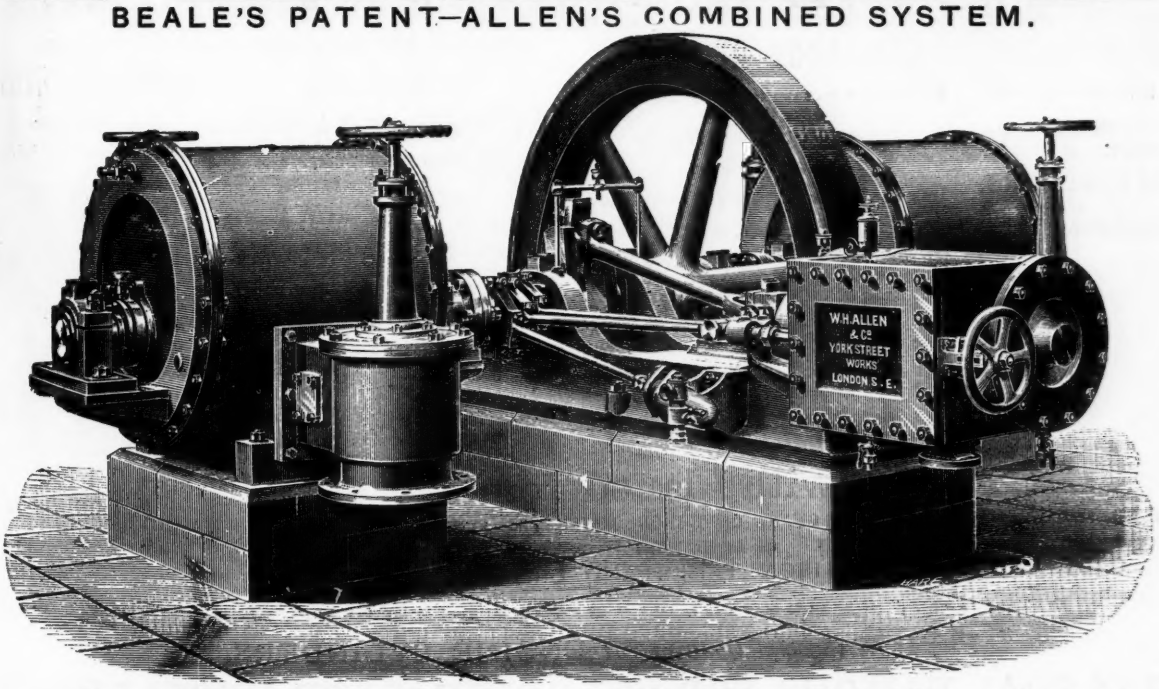

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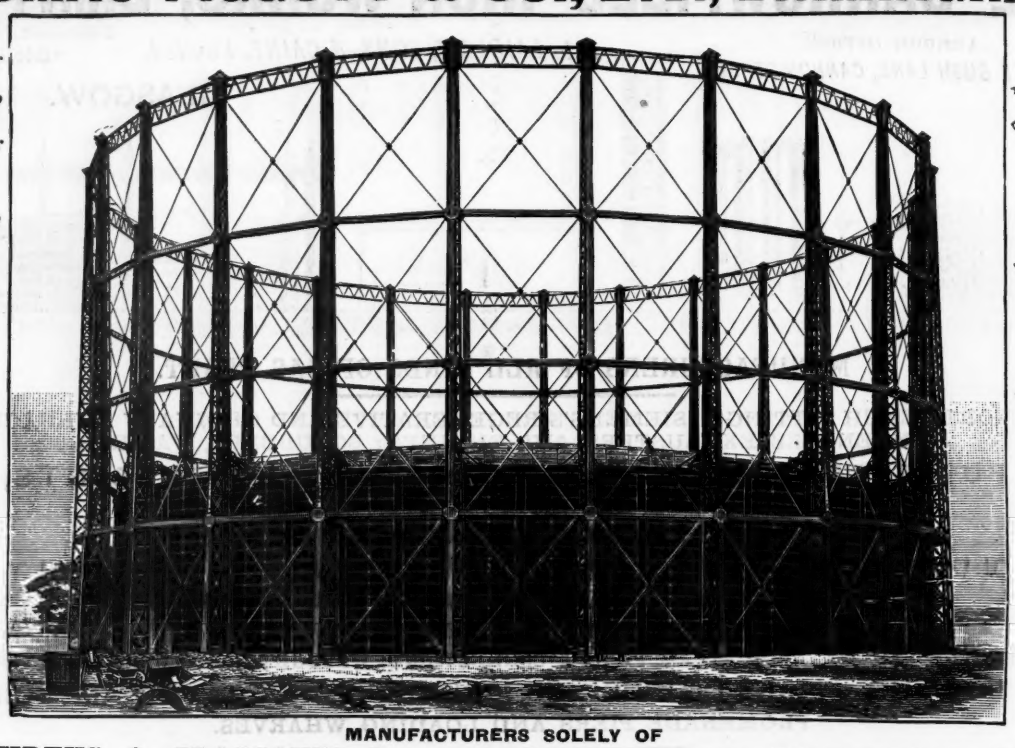

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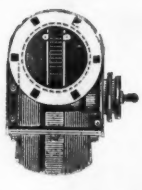

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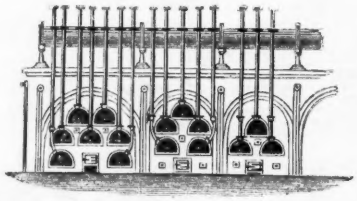

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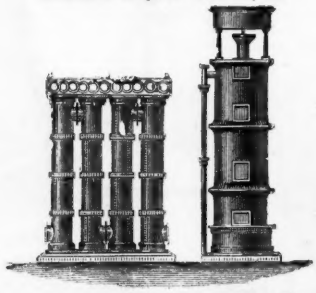

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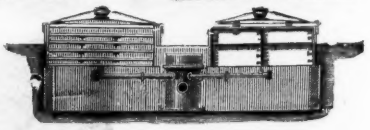

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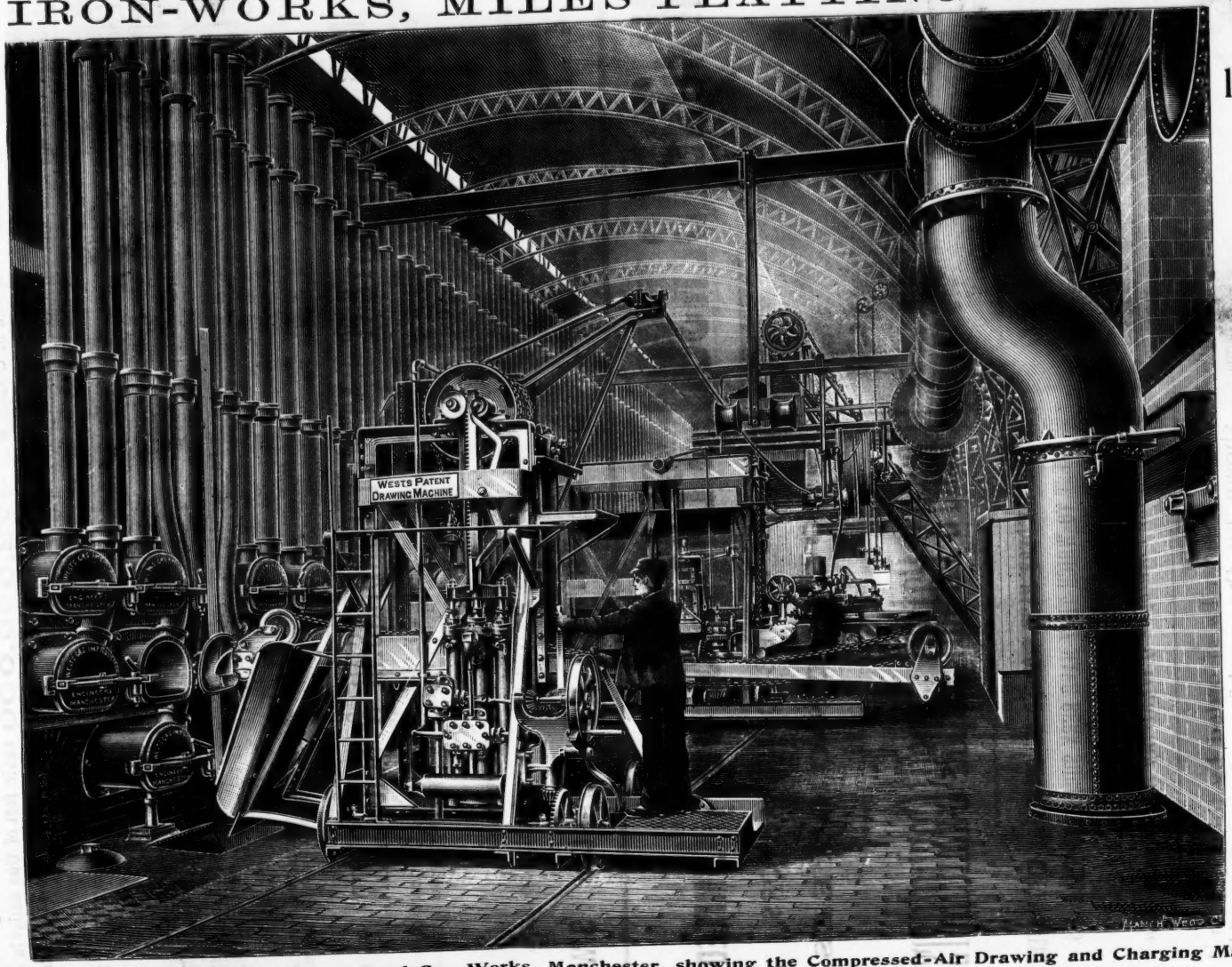

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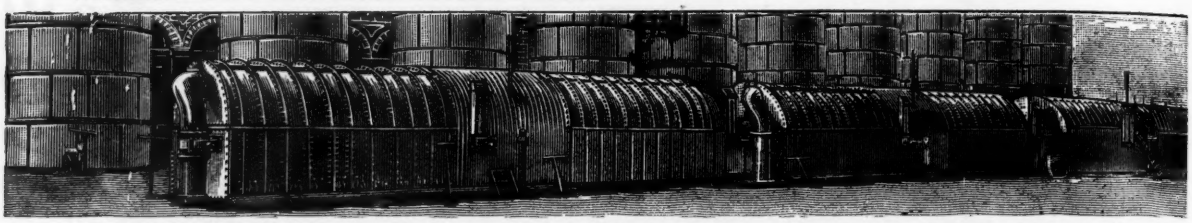

View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have 30 of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

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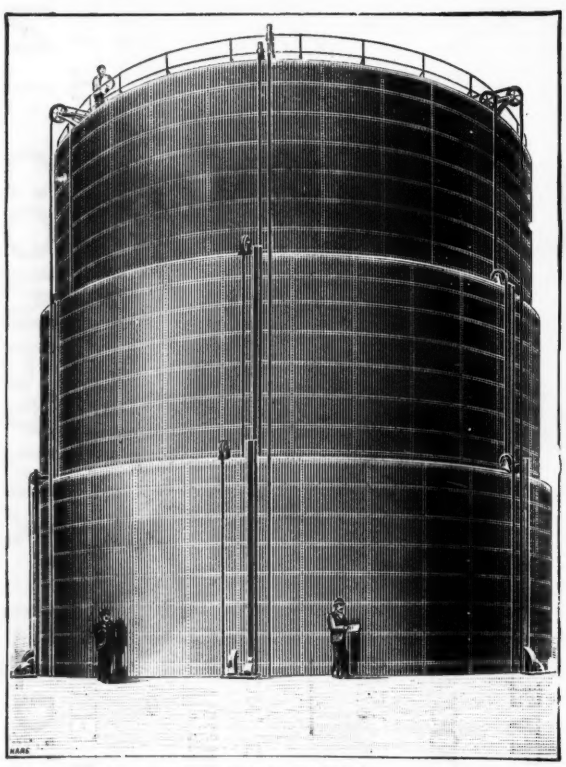

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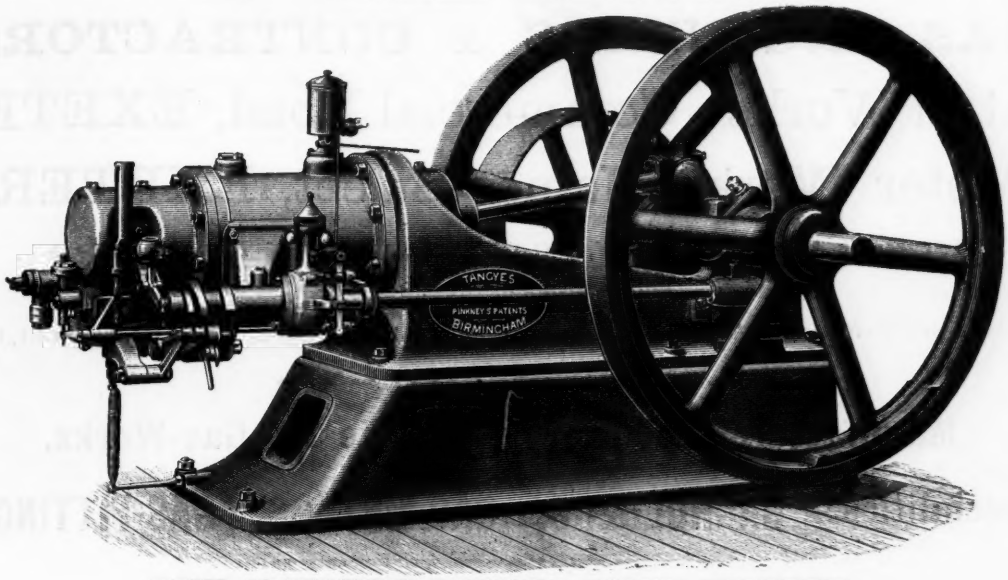

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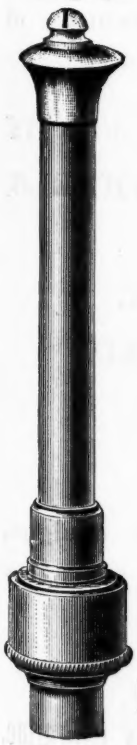

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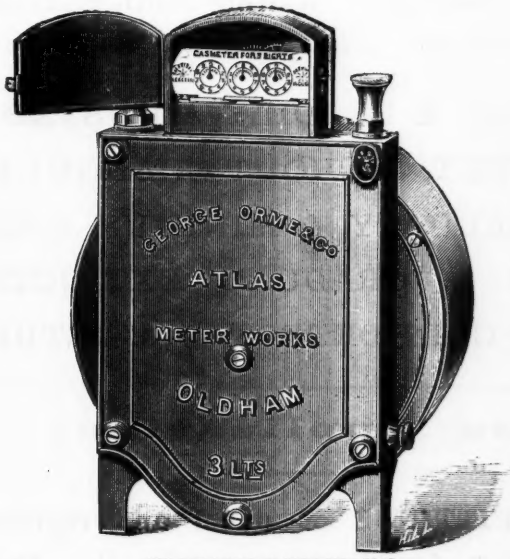

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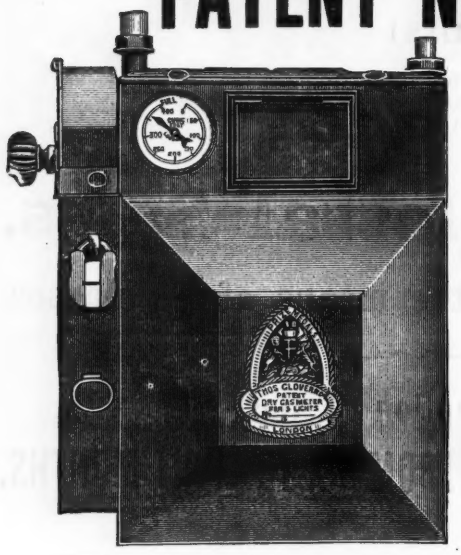

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EDITORIAL NOTES.

The Programme for The Gas Institute Meeting.

THE programme of the forthcoming Edinburgh Meeting of The Incorporated Gas Institute is now promulgated; and we have much pleasure in observing that it is highly creditable to the Council, and offers every promise of a gathering nowise inferior in interest and enjoyment to any of its precursors. Mr. Robert Mitchell, Engineer of the Edinburgh station of the Edinburgh and Leith Gas Commission, is President; and he will take the chair of the meeting on Tuesday, the 11th prox., at eleven o'clock, when the proceedings commence with an official welcome of the Institute to Edinburgh by the Lord Provost, Conveners, and members of the Edinburgh and Leith Gas Commission. In the evening, the Commissioners will give a reception in the Assembly Rooms. The severity of technical discussions is to be broken on the following day by an afternoon trip to the Forth Bridge; and Friday's excursion will embrace the ever-attractive Firth of Clyde and Loch Lomond round. With regard to the papers, of which there are ten in the *agenda*, besides a lecture on "Acetylene" by Professor Vivian B. Lewes, it may be said that the titles are promising, and most of the authors well reputed in connection with their chosen subjects. Mr. F. H. Medhurst, of London, will treat of "Gas as a "Motive Power in Generating Electric Energy for Private "and Public Lighting;" and if there are any other electrical experts in and about Edinburgh when he reads his paper, it is to be hoped they will help to elucidate the subject. Mr. F. W. Cross, of Wellington, Salop, has a paper on "The Practice of Districting, with a View to the "Equalization of Pressure"—of gas, be it understood. Mr. John M'Crae, of Dundee, is to treat of "The Manage-"ment and Remuneration of Gas Workers"—a subject which we are glad to see in the list. Mr. W. Newbigging, of Manchester, will reopen the question of "The Transfer "of Gas and Water Works Undertakings to Public "Authorities"—a matter which is well and abundantly illustrated by several Scottish examples. Professor Ivison Macadam, of Edinburgh, promises what should be an attractive discourse on "Illumination," with experiments. Mr. William Sugg will be at home, in one sense of the term, with a paper on Photometry. Mr. C. Stafford Ellery will describe some improvements in sulphate of ammonia manufacture. Mr. D. Irving responds to the challenge of the JOURNAL with a paper on "Un-"accounted-for Gas." Mr. Lewis T. Wright is to the fore with a communication bearing the title "Washing," which is assuredly conciseness brought to the verge of ambiguity. Professor Lewes, in addition to his lecture, already mentioned, will give a paper on "The Combustion "of Coal Gas for Fuel Purposes." Altogether, nobody can say that the Institute will be unworthily or meagrely employed in grappling with the foregoing list of papers, which is certainly as good a technical programme as the organization ever offered to its members.

Of the report of the Council, which accompanies the programme, we have but little to say. It states that there was an increase of 30 in the total membership at the close of the year; and that the balloting-list for the next election will, if approved, make the number of members of all classes over 600. We can sympathize with the Council in the regret they announce at the loss of the Honorary Secretary, Mr. J. Hepworth, who resigned on retirement from his appointment in Carlisle. Very few men would have done so much for the Institute as Mr. Hepworth did; and none could have done more. In Mr. Andrew Dougall, of Tunbridge Wells, the Institute will find an unexceptionable Honorary Secretary, who will persevere in maintaining the standard of conduct in this office established by his predecessor. We can congratulate the Council upon an improved revenue account, which is beginning to show the effect of better and more economical administration.

Self-Supporting Municipalism.

LAST Tuesday, Mr. E. O. Smith, the Town Clerk of Birmingham, who has recently become famous outside the Midlands as a member of the Royal Commission charged with the task of framing a scheme for the creation of a new London Municipality upon the ruins of the old Metropolitan local government systems, read a paper before

the Royal Statistical Society upon the subject of "Municipal Finance." As was only natural, when Mr. Smith said municipal in this connection, he meant Birmingham. He told the world a good many things, not altogether new, respecting Birmingham and its municipal affairs; and, of course, he had a good deal to say about the gas supply, which he included among the self-supporting corporation undertakings. We shall probably have something to say at another time with respect to the merits of Mr. Smith's paper. For the present we shall confine ourselves to remarking that to call such an undertaking as that of the Gas Department of the Birmingham Corporation "self-supporting," is to understate the facts; for not only is the undertaking in the question able to support itself, but it also supports a good deal besides that Birmingham would otherwise either miss very sorely, or have to pay for by some other agency. Even the *Standard*, when commenting upon Mr. Smith's statements respecting the Birmingham Gas Department, sees that this is only in one of its aspects a means of indirectly taxing a section of the citizens—namely, the gas consumers—for the relief of the ratepayers as a whole. The reflection is to be taken in connection with the familiar Progressivist argument that what Birmingham has done in this regard, London may also do with equal, if not more, advantage. It is desirable therefore, to repeat here the sufficiently obvious truth—which, however, Progressive eyes cannot see—that what Birmingham was able to do in 1872 is not necessarily open to be done for London in 1895. As we have recently been reminded by Mr. Albert Shaw, there was in the year 1872 a "psychological moment" for Birmingham, which Mr. Joseph Chamberlain was on the spot to utilize for inaugurating a forward movement in Birmingham municipalism. If there were to-day another Chamberlain in the City of London, or on the London County Council, he could not do the same for London.

In 1872, the undertakings of the London Gas Companies could have been bought up by a Metropolitan Gas Commission upon terms which in the light of present facts would appear extremely cheap. But nobody then wanted to do it at any price. The only Metropolitan Authority that could have taken over such a property was the Metropolitan Board of Works; and even the London County Council would confess that it was a good thing for the Metropolis that this body never had the chance of getting hold of the gas supply during any period of its existence. The Board, however, for all its faults, did better for the public than acquire the gas undertakings. It was partly instrumental in getting them regulated upon such a system of co-partnership with the consumers, that nothing remained after a few years to tempt a well-advised public authority to approach, with a view to purchasing them. In the expressive parlance of one of its most prominent members, the old Metropolitan Board of Works saw in the London gas undertakings nothing but "a sucked orange." The sliding-scale had done it. Why, then, do the Progressives of the London County Council seem to hanker after that in which their predecessors in Metropolitan government saw nothing attractive? Simply, as it appears, because they do not understand the matter. The leaders of "Progressism" in the London County Council are clever lads in their degree; but they are one and all remarkable for a total lack of experience in the details of Metropolitan government. It may be said that this observation is confuted by the fact of their having had several years' practice on the County Council; but the argument does not apply. In point of fact, these gentlemen jumped into office without passing through a period of apprenticeship of even the shortest duration; and the very men who want to supply London with water, to light it, and to govern the police force, besides attending to a multiplicity of other responsibilities, had no pretensions to admistrative training that a mere parish vestryman would respect. They can never get it now. This is not to say that new men, even those whose chief recommendation is their zeal, are not capable of doing excellent work upon the most important local authority; but they must not think their dreams are substantial enough to overcome the facts of history and actuality. Our latter-day Progressives know nothing of the struggle and toil through which the Metropolitan Gas Supply came to be what it is. But if they wish to learn something of the limitations of municipal enterprise, let them study such information as that contained in Dr. A. B. W. Kennedy's recent report upon the proposed purchase of the Newcastle-upon-Tyne electric lighting undertakings by the Corporation, to which reference is made in another column. If the same method of treatment is applied to the case of the London gas undertakings, it will appear even to the Progressive zealots of the County Council that this property is not worth buying for the assistance it could render to Metropolitan finance.

The London County Council and the Standard of Light.

THE London County Council have not delayed taking account of the recommendations of the Standards of Light Committee. In a report of the Public Control Committee to the Council, "great satisfaction" is expressed with the circumstance that the Board of Trade Committee have reported—which goes to show that we were not singular in entertaining fears lest the Committee in question should fail to report at all. An additional source of pleasure to the County Council Committee is discovered in the fact that it is the standard that was proposed by the Council's own Chemist—Mr. W. J. Dibdin—which has been recommended for adoption by the very highly respectable body of experts constituting the Board of Trade Committee. A vote of thanks to the Chemist "for his successful labour "and research in connection with this question" has been passed by the Public Control Committee; and we cordially agree that Mr. Dibdin fully deserves the encomium passed upon his work in this connection. With regard to the next step to be taken in the matter, the Committee recommend that a letter be addressed by the County Council to the Board of Trade, "again expressing the Council's opinion "of the urgent need for the provision of a more trust-"worthy standard of light for gas testing than the present "candle standard, and asking what action the Board "propose to take to give effect to the recommendations of "the Standards of Light Committee; and whether, having "regard to the unanimity and representative character "of the Committee, a short Bill for the purpose will be "promoted during the present session of Parliament." We agree that no time should be lost in giving effect to the recommendations of the Standards of Light Committee; but there is no occasion for rushing the necessary Bill through Parliament, even if this could be done, without sufficient preparation directed to secure unanimity among the representatives of the different interests that would be affected by legislation upon gas testing. Thanks to the Committee, and in no small measure to Mr. Dibdin individually, we have got word of a good working standard for testing ordinary coal gas; and we are in sight of an acceptable way of presenting the gas to it to be compared for illuminating power. But there remains the question of the photometer; and there would be no sense in asking Parliament to legalize a standard of light while there may be a dozen or more patterns of photometer to use with it, every one of them possibly capable of affecting the general result of the process. There must be agreement upon the photometer as well as upon the standard of light, before the testing of gas can be said to stand on a really rational footing.

More Dublin Litigation.

ANOTHER chapter has been opened in the interminable tale of the litigation between the Corporation of Dublin and the Alliance and Dublin Consumers' Gas Company. It will be remembered that in December last the Company had to sue the Corporation for payment for work done in connection with the public lighting service, and they obtained a verdict for £307. Of course, the Corporation could not put up with this reverse; and their natural rejoinder was to move for a new trial, which was heard in due course, and resulted in a judgment which we briefly noticed last week. Misled, however, by a Dublin newspaper, we recorded the judgment as being in favour of the Corporation. It is necessary to qualify the statement; and we accordingly refer our readers to the report of the case which appears in another column. It seems that, in reality, the four justices of the Queen's Bench Division of Ireland who heard the arguments, decided in favour of the Company upon three points, and for the Corporation only on one serious point. But this, if we understand it aright, is a very important one for gas companies. It is held that the statutory obligation to supply gas to public lamps does not carry with it, as the Corporation sought to make out, the consequential obligation of doing all that may be necessary to this end gratuitously by the undertaking. Categorically stated, the points given

in the Compa ny's favour are these: First, they are entitled to payment for all expenses for metering street lamps; secondly, they must be paid for service-pipes laid to public lamps at more than 50 yards from the nearest main; thirdly, the Company get the costs of the first trial in the Court below. With regard to the point or points upon which the Corporation succeeded this time, we confess to a difficulty of comprehension. There seems to have been a difference of opinion as to which party should pay for certain "bends"—meaning probably the rising bends necessary to connect the service-pipe in the ground with the service in the lamp. One side said these were part of the lamp; the other, that they were part of the Company's service. The Judges remarked that the question was a small one; but that it should have been raised at all shows the spirit in which these matters are dealt with in Dublin. At all events, the bends do not appear to have entered into the judgment. The really grave issue given for the Corporation was that, when they have once had a public lamp fixed and connected with the main, they may shift it to any fresh position they like; and the Company are bound to make, without charge, all necessary alterations of the service to suit. This was, according to the Court, the matter really argued upon the motion; and the Corporation having succeeded in it, are entitled to their costs. We cannot make out either the law or the sense of this part of the judgment. Of course, the matter is not finished. Nothing ever is finished as between the Corporation of Dublin and the Gas Company, if the lawyers can help it; and, as Justice Holmes remarked, "we will keep an open "mind on this point until we see the result." Will the Corporation henceforward amuse themselves, and keep their public lighting staff occupied, in shifting a few lamps every day, just for the fun of the thing? The question seems absurd; but if the judgment of the Court is as we read it, and gas matters in Dublin are managed as they appear to be, on the principle of creating the maximum of irritation for all parties concerned, what is to stop the Corporation from enjoying themselves in this way? It is a remarkable and perplexing state of a affairs.

The Lesson of the Price of Coal.

It has by this time become abundantly evident that gas coals are to be considerably cheaper this season than they have been for some time past; and the fact is to be chronicled here as a matter of contemporary interest, though anything that we can say respecting it can have no effect whatsoever upon the course of events. It is, in reality, as much for this reason as for any other that we mention the fact. Sooner or later the conviction is borne in upon everyone concerned in commercial affairs, that the influences that govern market prices are superior to, and independent of, sectional wishes and interested machinations. Now it is the buyers who find themselves able to bend, as they are apt to imagine, the market to their will. On the other hand, sometimes the sellers seem to be able to have everything their own way. The truth is that circumstances beyond individual or collective control determine these things, irrespective of everything like conscious design. The latest interest that has essayed to mould the market to its will is that of Labour, organized in a degree new in the experience of the world to this particular end. And now Labour is face to face with a state of things with which proprietors of commodities, and proprietors of money intended to be exchanged for these commodities, have long been familiar. It is not what one would, but what one can, that has to be considered in the conduct of human affairs, mercantile and otherwise. How does Labour take the lesson? At first, with blatant incredulity, expressing itself in passionate but unavailing revolt against the inevitable; but ultimately, with "sombre acquiescence." There may be troublous times in store for the coal mining industry, and the actual state of the market may well strain to the uttermost the arrangements that have been made during the last year or so to adjust the respective interests of all parties to the stern realities of the trade. But there is no disguising or getting over the fact that prices are in favour of buyers in every market. If coal is cheap, so are all other kinds of produce and commodity; and if a sovereign is hard to earn, it never had so much purchasing power as it now confers on its possessor. This seems to be the best comment that one can make upon the condition of the coal market. It is to be hoped that the lesson of the impossibility of controlling prices may be taken to heart by those who have of late years fallen under the temptation of economic heresies. In truth, it is no more within the power of man to say, for any period of time worthy of consideration, that coal shall sell at so much, and no less, than it is for him to declare that sixpence shall be worth a shilling, or, in the words of the immortal Jack Cade, that "the pint pot shall hold a quart." The lesson is difficult to learn, because of the variety of forms in which the problem is presented from time to time for solution; but the essential principle is always the same.

WATER AND SANITARY AFFAIRS.

Last week, at the close of our review of the proceedings before the Hybrid Committee on the Transfer Bills, we mentioned that it was the intention of Mr. Pember, at the meeting on Tuesday, to deal with the question as to whether the County Council was "the best body" to have charge of the Metropolitan Water Supply, supposing there was to be one public authority for the purpose, as contemplated by the Committee. It happens, however, that Mr. Pember's proposal has been in a great measure set aside already. When the Committee resumed on Tuesday last, the Chairman intimated that on looking through the petitions, after the adjournment, he found, while in several of them the point was raised that the Council was not a body well qualified for the purpose of managing the water supply, yet not any of the petitions formulated anything like a counter-scheme. Having consulted the other members of the Committee, he had to announce that they did not consider themselves at liberty to go into any alternative proposals. Yet Mr. Pember might, if he thought fit, cross-examine the witnesses in order to show whether the Council might or might not be the best body for having charge of the water supply. The rather odd conclusion was thus arrived at, that the Council might be shown as standing second best to something that was not specified. It is certainly easy enough to demonstrate that the Council is ill adapted to act as the one representative authority for the whole of the water supply. Neither is there any great difficulty in suggesting a representative body which could properly deal with the whole area over which the existing Companies have parliamentary powers. As for any alternative schemes, they are already coming into existence; for the London County Council have concluded an agreement with the Surrey Council for the sale to the latter of whatever relates to the water supply of that part of Surrey which is at present served by the Lambeth and the Southwark and Vauxhall Companies. The same plan is proposed for all the outlying areas. We presume that these arrangements come, or will come, under the cognizance of the Committee, in whose presence, in fact, they have already been announced. Yet this severance of the main scheme into several parts may be considered open to the objection we have already urged, that the plan consists in creating a congeries of authorities instead of one representative body. We cannot conceive that such a scheme will be found economical; and we may anticipate that it will prove increasingly defective, in proportion as the outlying areas become more fully populated, so as to be attached more intimately to the Metropolitan centre. As the Metropolis outgrew the City, we may, in like manner, expect the suburbs to grow outside the Metropolis, so as to become virtually part of London itself. Whether the County Council would be able, consistently with its other duties, to take charge of the vast and intricate operations of the Metropolitan Water Supply, is a further question, and one of very serious character. The risk of nearly the whole of the County Council being turned out at a triennial election also affects the efficiency of that body for the management of so important an undertaking as the water supply of London, fraught as it assuredly is with vital issues.

At the sitting of the Committee on Friday, Mr. Cripps, the Parliamentary Agent of the County Council, gave evidence on the subject of the arbitration clause. He said the directions given related to matters which might reasonably and fairly be taken into account in fixing the price of the transfer; and special directions were necessary in regard to them, "or it was probable that they might "not be taken into consideration by the Arbitrator." This is equivalent to acknowledging that unusual conditions

are introduced into the arbitration. Mr. Cripps tries to gloss over this fact, by saying that the Council only intended that the Arbitrator should "have regard" to the matters in question. If, on paying attention to them, he thought they were "worth nothing," he would treat them accordingly. But, as we read the clause, the imperative terms employed are by no means suggestive of this free-and-easy interpretation. In the latter part of his evidence on Friday last, Mr. Cripps made certain remarks which clearly point to some further rigour in the exercise of arbitration; if it can be brought to pass. It is suggested that, the frost having checked the supply, the Lambeth Company should lose a quarter's income, and suffer a proportionate reduction in the terms of purchase. According to the tender mercies of the County Council, we hardly know what is to become of the Lambeth Company; but more is to be learned on this subject to-day, when Mr. Cripps resumes his evidence. Bearing on the subject of the supply of water as carried out by the Companies, we call attention to an article in another column, analyzing the extensive report in which Dr. Frankland deals with the Metropolitan Water Supply of the past year.

Sir W. H. Wyatt, in presiding over the half-yearly meeting of the West Middlesex Water Company last week, naturally referred to the recent trouble arising from the frost, and to the continued onslaught of the County Council. A fine stroke of parochial policy on a small scale was mentioned, in the demand made on the Company to pay for the cost of removing the ice which had collected round the stand-pipes set up to supply the consumers during the frost. If the local authorities had been willing to take the responsibility, the accretion of ice could have been prevented by dispensing with the stand-pipes. But the parishes simply declined the alternative when it was offered to them; and most of them have abandoned their claim. Assuredly, a little grace might be shown in return for the £25,000 per annum which the parishes receive from the Company in the form of local rates. This parochial question, however, and even all the expense contingent on the frost, is but a feather on the camel's back compared with the burden laid on year by year, and especially this year, by the County Council. For the Company to be thus annually mulcted in a large amount for costs, was referred to by the Chairman as "most objectionable." The semi-official *London* takes up this remark as applying to "the proposal to acquire the Water Companies in the "interests of the public." The proposal is one thing, and the mode of carrying it out is another. It was the repeated cost of the parliamentary struggle to which Sir W. H. Wyatt objected. The policy of the Council is to harass and to damage, and ultimately to "acquire" the property of the Water Companies at a price far below any reasonable scale of compensation. But, despite all threats and perils, the West Middlesex Company are going on with their work, so that the supply shall be maintained. Two new engines and their boilers are nearly complete; and there are to be four new reservoirs. Parliament only last year gave the Company power to raise £440,000 for the construction of additional works, and of this amount £100,000 will be required in the autumn. This is an expenditure which the County Council would like to prevent, though the benefit of the outlay will accrue to the public, and not to the Company.

Following closely on our articles upon the question of the legal position of suppliers and consumers of water, as affected by the occurrence of exceptional frost, comes the Reading case, reported in the last issue of the JOURNAL. It is peculiarly fortunate, perhaps, that the dispute which the Reading Magistrates were called upon to deal with arose between a water consumer and the Reading Corporation. What is considered to be sauce for a company is not invariably regarded as sauce for a corporation; and it is wise, therefore, that the public should be thus reminded that, in this matter of hard frost and its consequence, there is not a pin to choose between corporations and company shareholders. Both are in the same boat, and the crime, if crime it can be regarded, for which the London Water Companies have been noisily arraigned, is as common to local authorities as it is to those who supply water for profit. It is even conceivable that the London County Council, when, if ever, it enters on possession of Naboth's vineyard, may have to encounter the serious consequences of an exceptionally severe winter. What, in that contingency, will the Council do? Let all the water consumers off, or contend, as the Reading Corporation did, that frost comes from "the hand of God," and that water-rates are not apportionable? The future alone will solve that question; and we have our own very distinct impression as to what the solution will be. Meanwhile, there is the Reading case, in which the local Justices have conferred immunity upon the local Corporation for their alleged shortcomings. The Justices, in our opinion, were perfectly right; and if they were right, what sense or justice is there in all the fuss and fume which certain persons and newspapers have set themselves sedulously to work up in the neighbourhood of the Metropolis? Of course, no magisterial decision possesses the character of binding authority in a Superior Court, or even in one of concurrent rank; but there is so much practical common sense and "sweet "reasonableness" in the Reading ruling as to amply confirm and illustrate the views which have more than once been expressed in the JOURNAL. The Reading Corporation, face to face with a frost the like of which, according to their Water-Works Manager, had not been experienced locally since 1854, did the best they could to cope with the difficulty, and meet the requirements of the inhabitants. Throughout the kingdom it was practically the same. Neither corporation nor company can achieve, or be reasonably expected to achieve, the impossible.

The question of the period over which the repayment of money borrowed for the purpose of buying water undertakings may be spread has from time to time been discussed in our columns, more particularly in relation to the present campaign against the London Water Companies. We have pointed out that, unless the sixty years rule fixed by the Standing Orders, and adopted in the Public Health Act, 1875, can be broken through, nearly all the proposed purchases of which so much is heard become financially objectionable from the point of view of the present generation of ratepayers. This was frankly admitted by the Portsmouth Alderman who recently made a speech in support of the scheme for buying up the water-works of that town and district. Sheffield was allowed, despite Mr. Leonard Courtney's earnest protest, to take ninety years for repayment. Portsmouth also wants ninety years; and, of course, when the question of acquiring the works of the several Companies at present supplying Bristol, Newcastle, and Sunderland comes to the front, very similar argument may be expected. That is the danger of creating exceptions to a wisely-ordered and well-considered principle. Of course, the most prominent illustration of this persistent attempt to encroach on parliamentary rule and practice is to be found in the Money Bill of the London County Council, which is framed so as to provide that the Council shall made provision for the redemption of any stock created, or the repayment of any money borrowed or expended on capital account for the purposes of the Act, "within a period of not exceeding one "hundred years from the date of the expenditure." The significance of the attempt will be thoroughly appreciated; and very much depends, not only for the Metropolitan Water Companies, but also for threatened water undertakings in the Provinces, on the view the Legislature may take of this persistent undermining of the general law and well-settled parliamentary rule.

Mr. J. H. Spokes, one of the Directors of the Slough Gas Company, died on Sunday week. Early last year, he was seized with a paralytic stroke; and this was the commencement of the illness which ended in his decease. Mr. Spokes was 69 years old.

Institution of Civil Engineers.—At the ordinary meeting of this Institution last Tuesday, Mr. J. Hawksley, of the Portsmouth Water-Works, Mr. W. Ingram, the Assistant Water Engineer of Plymouth, and Mr. Sophus Simmelkjör, of London, were admitted as associate members.

Death of Mr. Charles H. Parkes.—The death has lately been announced of Mr. Charles Henry Parkes, whose name will be remembered by many of our readers as that of the first Official Auditor appointed by the Board of Trade to examine the accounts of the Metropolitan Gas Companies; and his name regularly appeared at the foot of the accounts till about two years ago. Mr. Parkes was in early life in the Election Office of the House of Commons; and he subsequently joined the firm of Messrs. Dyson and Co., Parliamentary Agents. He will be best remembered, however, for the excellent work he did in connection with the Great Eastern Railway Company, with which he became associated in 1869. Mr. Parkes was appointed Vice-Chairman in 1873, and Chairman in 1874. Under his guidance, the fortunes of the concern advanced considerably; and, on his retirement in 1893, his great services were recognized by an award of 2000 guineas. Deceased was in his 79th year.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION, WHITEHALL,

MAY 8TH & 9TH, 1895.

Mr. C. C. CARPENTER, Assoc.M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

We continue to-day our report of the technical portion of the proceedings at the above meeting by giving the discussion on Mr. J. Husband's paper on "Sloping Retorts," which appeared last week, and the papers by Mr. F. W. Stevenson and Mr. T. Holgate—on "The Manufacture of Sulphuric Acid by Sulphate of Ammonia Makers" and on "Purified Ammoniacal Liquor and its Use in Gas Purification"—with the remarks made thereon.

DISCUSSION ON MR. J. HUSBAND'S PAPER ON "SLOPING RETORTS."

The PRESIDENT said they had long been looking forward to a paper from Brentford descriptive of the inclined retorts in use there; and it was very satisfactory to find that Mr. Husband had kindly supplied the want.

Mr. J. F. BRAIDWOOD (West Greenwich) said they had been working inclined retorts for more than four years, though not exclusively. He could not very well compare Mr. Husband's figures with theirs, as his figures did not give the cost of carbonizing per ton. He gathered that he worked on eight-hour shifts; and, if so, on the quantity of gas made, it would be about 1s. per ton. His own ran out at about 1s. 2d., which compared with the best hand-work at 2s. 3d.; so that they saved 1s. 1d. per ton. In the four years' working of the inclined retorts, they carbonized about 70,000 tons of coal. He thought the gas obtained was rather above that made by horizontals. As regarded the reduction in labour, there was no question about that; and the men gave the preference to the "slopers," as they were called. They had no machine work; and therefore there was no chance of comparing it with that. He believed, for small to medium-sized works, the inclined retorts had an advantage over machinery; but in the case of large works, with a long range of retorts, it was quite possible a machine might be found to compete favourably with them. The duration of the retorts was another thing. Some sets had been in work two years; but they had to repair them while in action occasionally. He did not think they would go as long as horizontal settings. They had various qualities of coal to be used just as it happened to come. They transferred it direct from the ship into overhead hoppers by a hydraulic lift. Some kinds would carbonize better than others. As regards the layers of coal, they were put in perfectly even. Certain coals would lie evenly throughout the carbonizing; while others would shift down of their own accord, but not to any damaging extent.

Mr. G. WINSTANLEY (Coventry) said he had not come prepared to enter into the discussion, as he thought more could not be added to the statements he had previously made in connection with the subject. There was, however, one statement he noticed in the paper—viz., that the amount of fuel used was 8 per cent. This, he thought, required some explanation. He found, on balancing the stock at the termination of each year, they used at Coventry between 6 and 7 per cent.; but, when the fuel tests were made by weight extending frequently over a week, they found the actual amount consumed was about 10 lbs. of coke per 100 lbs. of coal carbonized, or (say) 10 per cent. With regard to the class of coal, they used a greater variety than was done in London—some five or six different sorts. The larger kinds were broken up; but all below 4 to 6 inch cubes were passed into the hopper for use. The men were so accustomed to regulate the charges, that no difficulty occurred in using coal of the mixture and sizes named. Sometimes with the rougher coal it was found, on opening the retorts, that a slip of 18 inches or 2 feet had taken place; but with the finer coal no shifting occurred. The illuminating power of the gas made in the inclined retorts was not found to differ from that produced in horizontals. He had stored the gas in a separate holder; and at the end of a week no loss was shown. In other respects, it seemed that they were working practically on the same lines as those at Brentford; only at Coventry their costs were considerably less—being only 1s. 6d. per ton of coal carbonized. This figure included all charges on the work from the time the coal entered the elevator until the coke had been stacked in the yard, including attention to the fires. The wear and tear had been a little greater. The first retorts had not lasted quite so long on this system as on the horizontal. The reason they now quite understood; and it was due, in great measure, to the whole structure being new. This could be altered when the retorts were reset; and then the little differences would be overcome. Another reason might be this—the charges were considerably heavier than in the horizontal retorts; being about 7 cwt. in a 15-feet length, and were usually of six hours' duration. Probably the constant friction of this heavy weight would wear them out a little sooner, although possibly during their life they had carbonized a greater weight per foot in length than horizontal retorts would have done. There was also the fact that a stronger heat had to be employed, in order to burn off this thick body of coal. With regard to repairs, they found no difficulty whatever in repairing this class of setting, either when in work or when let down. Practically the only benefits derived from the use of such a system were these: Very ordinary and cheap machinery could be used; there was small cost in working; they had power to employ labour outside the ordinary class of men engaged in the retort-house; and space was saved. The fuel, heating, and general arrangement of the setting would be the same in both systems; and very little saving could be attributed to the inclination of the retort or its setting. The saving only occurred from the use of outside arrangements. This was his (Mr. Winstanley's) experience; and he was to-day as strongly in favour of the use of sloping retorts as he had been from the time of their introduction.

Mr. G. C. TREWBY (London) said the Institution were much indebted to Mr. Husband for bringing this subject forward for discussion. The Gaslight and Coke Company, in order to test the efficiency of the system, had put up an installation at their Bow Common works exactly the same as at Brentford; and this had now been at work for upwards of six months. But they were in the hands of contractors—Messrs. Gibbons—who were under an obligation, if necessary, to work them twelve months. As far as he was personally concerned, he preserved an open mind on this question. There were certain advantages; and certain disadvantages. They had not been able to verify the statement made in the paper that there was no difference in the sperm value derived from the coal. They did not get the same amount from a ton of coal carbonized in sloping retorts as in horizontal; and it probably arose from the fact that every now and then they found charges which had not burnt off, and, therefore, there was a certain amount of waste. The author said: "Given a retort charged with coal of a certain quality, and given a certain heat, the make of gas, the candle power, and the coke must be the same." They did not find this to be so. It was rather a startling statement also that "the profit arising from the working of inclined retorts is such that it was shown that the whole cost of transformation would be covered in two years' working." He should like Mr. Husband to supplement his paper by showing in figures how this was arrived at. Further on, he took credit for generators and regenerators with his inclined retorts, as compared with horizontal retorts without generators and regenerators; and he could not consider that was a fair comparison. He did not see why there should be any saving in fuel between sloping retorts and horizontals, supposing they were both fitted with generators on the same plan. There was another statement to the effect that, with a light roof over the buckstaves, all that was necessary to produce a million cubic feet of gas per day could be erected for £1600 from the ground line. If his memory served him aright, they paid Messrs. Gibbons just under £11,000 for their installation, which was for a million feet. He was sure the Institution would be very much indebted to Mr. Husband if he would add

to his paper what the £1600 included. There was another slight inaccuracy where he charged the carbonizing account with gas at the selling price, because he said, with gas at 4od. per 1000 cubic feet, this meant 4d. per ton of coal saved. In this they had interest on capital, collectors' charges, and everything else; but he only debited the gas-engine with gas at 1s. 9d. per 1000 feet. In another twelve months, The Gaslight and Coke Company would be better able to judge of the results. They knew labour was an important item; but it was not everything. They wanted the full sperm value from the coal; and if there was a falling off, it should be compensated for in other ways. He would ask Mr. Husband if his own Company had not introduced these sloping retorts to a large extent at Southall and Brentford. Now, looking at Field's "Analysis," as far as the working of the Brentford Company was concerned, he found that, going back a few years before the sloping retorts were introduced—viz., in 1890—they used 1·31 per cent. of cannel; they sold 10,133 cubic feet of gas per ton; and their illuminating power was 15·2 candles. When they came to 1893, they used 1·36 per cent. (or practically the same) cannel; they only sold 9542 cubic feet of gas per ton; and the illuminating power was 14½ candles. Therefore there was a reduction of 600 feet of gas per ton; and a diminution of $\frac{7}{10}$ of a candle. In 1894, they used 1·1 per cent. of cannel; sold 9624 cubic feet of gas; and the illuminating power was 14·7 candles—a reduction, as compared with 1890, of 500 feet of gas, and of ½ candle in the illuminating power. No doubt this could be explained; but with all the advantages shadowed forth in the paper, one would expect that the working would be as good at the present time as it was a few years ago, before the introduction of sloping retorts.

Mr. Fletcher W. Stevenson (Sheffield) said he had had no personal experience of sloping retorts; but, like all other engineers, he had seen a great many of the installations that had been erected, although not the Brentford one. Whenever the question came up at Sheffield, he always advised waiting—firstly, because he thought it was a mistake to rush too quickly into new things; and, secondly, because he knew they had been used at Brentford, and he could never see, from an inspection of Field's "Analysis," the advantage which had always been claimed for these retorts. Referring to the "Analysis," under the head of "Carbonizing Wages," he found in 1891 at Brentford the figure was 4s. 3·99d. per ton of coal; and in 1893, 3s. 5·35d. But the average of the Suburban Companies for the latter year was 3s. 5·09d.; and he should like to know where the saving in wages came in. Mr. Husband had said they had still some horizontal retorts at work. He presumed there could not be very many; and therefore there ought to be a considerable saving shown in wages. Of course, the difference between 4s. 4d. and 3s. 5d. was a considerable saving; but it was based in such a high rate to start with, that he ventured to think it could have been effected in other ways, and might not be altogether due to the sloping retorts. The introduction of machinery or other improvements might have had the same effect; and perhaps even to a greater degree. He thought, therefore, he should still prefer to wait until they could hear why this saving of wages did not appear in the yearly accounts.

Mr. B. W. Smith (Smethwick) said he noticed that Mr. Husband estimated the total quantity of coal carbonized as 30 cwt. per 24 hours per retort, which, as far as he could calculate, gave 10 tons 10 cwt. in the 24 hours with a setting of seven. Now at his works, where regenerative furnaces were adopted, with the same length of retorts, they carbonized 14 tons 14 cwt. These were horizontal eights; and the work was done in three shifts of eight hours each. One of the speakers mentioned the amount of fuel consumed as 8 per cent.; but was that 8 per cent. calculated after the waste coke had been taken from the clinkering, or the refuse from the furnaces? The amount of breeze was extraordinary; and he could not understand how the coke, falling such a distance, should not make more breeze, as it must fall into the floor below, or into a barrow at the bottom of the mouthpiece. With regard to the make per mouthpiece, he found it was 8080 cubic feet; but with his horizontal settings with a push he could make above 10,000 cubic feet, and, under ordinary circumstances, about 9600 cubic feet.

Mr. J. Methven (Beckton) said he should like to call attention to the cost of working given in the paper, because he did not think the comparison was quite right. For instance, there was a ganger put down for the "slopers" at 6s. 5d.; but there was no ganger appearing for the horizontals. On the horizontal side of the account, there were two firemen, two firemakers, one poker-in, one breeze-boy, and one coal trimmer. A great deal of this labour undoubtedly was saved with inclined retorts; but that had nothing to do with them. It was probably due to the description of furnace used for heating the retorts, and to the introduction of machinery for taking the coal up and dispensing with labour. A strict comparison between the working of horizontal and sloping retorts could not be made with those items included. Then, it was mentioned in the paper that there was no breeze now for sale out of the sloping-retort house; but this state of affairs could not be justly attributed to the retorts. He was at present working under the same difficulty at Beckton. He could not get enough breeze to use in his furnaces. If they were only fortunate enough to have the regenerator furnace which Mr. Morris had adopted at Brentford, and to which Mr. Husband referred in his paper, they could effect a considerable saving in the amount of fuel. Notwithstanding this, they were able in their furnaces (which were in the majority of cases generator only, and not regenerative) to use the whole of the breeze produced; so that he did not think that that was an attribute of sloping retorts.

Mr. J. Young (Hanley) said he had had the opportunity of seeing several installations of sloping retorts; but he was in the unfortunate predicament of having to take other people's figures, as he had not any working. But in his immediate neighbourhood, there were some four installations—most of them, however, being used in carbonizing works, for the purpose of manufacturing residual products only; and so the quality of the gas was not any object. There, if anywhere, he thought sloping retorts would have the greatest chance of success. He had the privilege of going to these works whenever he liked, without giving any notice; and he was not very much impressed with the results he saw there. One of the managers of the largest installation had recently built a carbonizing works for himself; and, to his (Mr. Young's) astonishment, he had returned to the horizontal system. When he questioned him about it, and suggested he must have lost faith in the "slopers," he said not at all; and he believed in them for gas-works, but they were of no use for carbonizing works. He stated that they lost a gallon of tar, one-sixth of the benzol, and 4 lbs. of sulphate for every ton of coal they carbonized. Now benzol especially appealed to him as a gas maker; and he thought that the illuminating power would be lessened considerably by the adoption of "slopers." With regard to the quantity of fuel used, he agreed with Mr. Methven that it had nothing to do with this particular setting. The amount of coke per ton of coal carbonized that the Brentford Company had sold was astonishing. It was as much as some of them made; and perhaps it was accounted for by the fact that they used a little breeze from the other houses for fuel.

Mr. W. R. Herring (Huddersfield) said he had already, on a former occasion, expressed his opinion definitely with regard to inclined retorts; and twelve months' further experience had confirmed that opinion. He thought some of them were too apt to think that, if they introduced improvements, they ought to reach perfection immediately, to have none of the defects of the old system, and that everything should work perfectly smoothly. But, as a matter of fact, in anything new that was introduced, every little thing that went wrong was immediately reported to the manager; and he was apt to think there were far more difficulties than with the old system, whereas the men had become used to the difficulties with the old plant, and managed to get over them. If he had had the paper earlier, he could have given some figures with regard to the new installation which was being erected at Huddersfield; but, speaking generally upon the paper, he would say, with regard to the nature of the work and the workmen, that, while Mr. Husband said the men never stripped, he could go one better, for his men worked with their coats on, and not many months ago some even had mufflers round their necks. The men themselves agreed that the work was easier—of course, he spoke as compared with hand work—the charging of inclined retorts being really women's work. With regard to drawing, there was not very much

advantage at Huddersfield at present. It was a ground-floor house; and, particularly when the retorts were slightly out of shape, the coke required pricking far more than he liked to see. Still they were overcoming this by introducing taper retorts into some of the settings they were rebuilding. Having a full-sized mouthpiece at the top end in order to utilize the original castings, and with 2-inches taper on the sides, he believed they would find that the men would have to look after the coke instead of having to assist it out. There was no scurfing required. If the doors were opened top and bottom for a short time, the current of air was sufficient to burn it all off. The men actually worked something under four hours during the eight-hour shifts. The author of the paper asked, "Why is the system not more generally adopted?" but the question was not accompanied by any remark as to the extent that it had been adopted. They looked to the Brentford engineers as pioneers in this matter; and he thought they deserved every credit for it. The places, however, where this system had been adopted included Burnley, Coventry, Chatterley, Droylesden, Gateshead, Huddersfield, Leigh, Middlesbrough, Newcastle-under-Lyme, Rochdale, Salford, Tunstall, West Hartlepool, West Greenwich, Bow Common, including Brentford and Southall; and out of this list there were no less than eight works where the system had been extended after a lengthened trial. That he always thought was the best evidence of whether or not a system was going right. With regard to the wear and tear of the retorts, he thought it ought to be calculated according to the weight of coal carbonized rather than by the absolute life of the setting. Their settings lasted about 500 days, which was very fair considering they were entirely new work. In some cases the upper ends had perhaps 15 or 16 feet of new brickwork beneath them; and there was bound to be a certain amount of contraction in the clay joints, and more settlement than there would be on re-setting on a future occasion. Most of the systems spoken of had been entirely new work, with new generators beneath. They had found difficulty at Huddersfield in the bye-passing of coal from the top hopper through the measuring chamber into the charging-shoot; and he would like to ask Mr. Husband whether any means had been adopted by him to overcome this defect. The valve arrangement was such that, if the lever was at half stroke, the top valve was half open, and the bottom valve half open. Consequently the coal could run continuously; and he found some of his men were very curious to see what the effect would be of such an experiment. The consequence was they would completely fill the retort from top to bottom. To overcome this, he introduced a balance-flap arrangement, which did not allow any coal to fall from the measuring chamber until the top valve was closed. It also had the additional advantage that it was impossible for the man to re-draw the lever, so as to close the bottom aperture, until the whole of the coal had run out. The act of running out kept the flap down, and prevented the closing of the valve; and by this means, they knew for a certainty the weight going into the retorts—the man could put in neither more nor less than the chamber was arranged for. With regard to fuel, he might say that he had sold 14 cwt. per ton; but he should not like to say that he had made it, or how much of it was water. With regard to the illuminating power of the gas and the quantity made, he must say he found the production slightly in excess of the horizontal system; and he attributed it to the quicker closing of the doors. But that was comparing it with shovel charging, which was far longer even than scoop charging or machine work. The illuminating power was practically the same. As to the cost of construction, there was no doubt in his mind it could be done for £80 per ton of coal carbonized, and in a most substantial manner; and when they compared the advantage of the smaller area occupied per ton of coal, it brought the cost to about the same as the ordinary horizontal system, apart from the cost of charging machinery for the latter. In his new installation at Huddersfield, he had arranged to carry the whole of the weight of the pipes and mouthpieces, together with the hydraulic mains, &c., from the superstructure; and thus they relieved the whole of the brickwork and retorts from any incumbent weight—giving perfect freedom to move without interfering with the mains in the least. The wear and tear of the elevators, &c., he also found to be very small. Actually it cost them 1¼d. a ton for elevating and conveying; and altogether 1s. 6d. per ton for carbonizing, including stokers' and firemen's wages, wheeling out coke, and clinkering, and a portion of the foreman's wages. The fact mentioned by Mr. Young, of inclined retorts given up in carbonizing works—the reason being the loss of tar and tar products—he thought should be in favour of the system. It simply showed that they were carbonizing better from a gas maker's point of view, and that the carbonizing was too good for the products men. The object of gas engineers was to make gas, not residuals.

Mr. HUSBAND, in reply, said, with reference to the coal running down the retorts, they did find that at first. But, on examination, it was found to be the men's fault entirely; and for the last six or eight months, they had had no trouble in this respect. With reference to the fuel, he worked out the 8 per cent. from the coke sold into the street. There were 12½ cwt. of coke per ton of coal sold. With regard to Mr. Trewby's remarks about the £1600, this was a mistake in the paper which would be corrected. With reference to the cost of carbonizing at Brentford, he might say the figures had been mixed up rather in Field's "Analysis." The yard work, and all that sort of thing, was put down to carbonizing; and if a man went inside to stack pipes in the yard, it was put down to carbonizing. In the next report (1895), they would see it very different. The coke was drawn straight away, and fell into a coke-hole. The new house had only been working six months; and the figures given were those at which they had been working. Including houses Nos. 1 and 2, the men did sixteen sets. He reckoned one man to four sets at the bottom, one at the top end, and one pipe-jumper, who had to help at the work if required. They had used various kinds of coals, and did not find much difficulty in charging. The average charges were for the top retort about 8 cwt., and at the bottom about 7½ cwt.; the average being 7½ cwt. on the year's work. The settings of horizontal and sloping retorts had the same regenerator furnace. The difference in fuel was due, he thought, to having six sloping retorts in a setting, as against seven in the horizontal setting. Less heat was required, and more coal was carbonized.

Mr. TREWBY asked if Mr. Husband meant that sloping retorts carbonized more coal than horizontals.

Mr. HUSBAND said the inclined retorts were bigger. The old sevens were 21 inches; and these were 24½ inches. With reference to the wear and tear, with his experience of the new house, he did not see why they should not last four years. With regard to the make of gas per ton, he thought it was about 100 cubic feet more.

Mr. YOUNG said he believed the figures showed there had been a falling off of 500 cubic feet since "slopers" were introduced.

Mr. HUSBAND replied that they found the "slopers," when worked by themselves, made more gas. The only reason he could give for the falling off shown was that there must have been a difference in the quality of the coal. His experience had been that they made more gas, simply because they were charged quicker. The coal used was nearly all Ravensworth and Deafhill. The average illuminating power was generally about 15 candles.

THE MANUFACTURE OF SULPHURIC ACID BY SULPHATE OF AMMONIA MAKERS.

By FLETCHER W. STEVENSON.

The manufacture of sulphuric acid is exceedingly simple, and will usually be found profitable to those who are makers of sulphate of ammonia, as the sulphuretted hydrogen evolved during the distillation of ammoniacal liquor yields a very considerable proportion of the sulphur required in its manufacture. Sulphate makers have to deal with this sulphuretted hydrogen in one of three ways: (1) Absorption in purifiers containing oxide of iron; (2) deposition as brimstone in Claus kilns; (3) burning direct for acid making. Which is the most sensible and the most economical is at once apparent, when it is remembered that the sulphur obtained by the first two methods is sold to acid makers who have their own profit to make after bearing the cost of transit as well as of purchase; while in the last it is utilized *in situ* without labour or charge of any kind. It is believed that, if the ease with which sulphuretted hydrogen can be utilized and rendered profitable by burning for the production of sulphuric acid, were more generally known, the manufacture of this article

would more often be found in connection with large sulphate works; and it is with the hope of turning attention to the subject that the author has ventured to prepare this paper.

Though so many thousands of tons of acid are used annually upon gas-works for sulphate making, very little information has ever been laid before meetings of gas engineers upon its manufacture; and to Mr. J. Hepworth must be attributed the credit of first recommending the manufacture, and giving particulars of its cost. In 1883, he read before the North of England Gas Managers' Association a paper entitled "Results Obtained in the Manufacture of Sulphate of Ammonia and Sulphuric Acid;" and in 1885, another before The Gas Institute on "The Manufacture of Sulphuric Acid in Connection with Gas-Works." But in neither of these does Mr. Hepworth recommend the manufacture of acid by direct burning of the spent oxide; while in his second paper he absolutely deprecates it, and recommends in preference the sublimation of the sulphur in the spent oxide, and afterwards burning the sulphur separately. As this is not the plan generally adopted, nor the most economical, the author proposes to give particulars of the plant now in use by the Sheffield Gas Company, and show its special adaptability for those who also manufacture sulphate of ammonia.*

Without entering fully into all the reactions taking place during the manufacture, the process of making sulphuric acid in its simplest form may be described as follows: The sulphur required is obtained partly from spent oxide and partly from the sulphuretted hydrogen of the ammoniacal liquor distilled for sulphate making. The sulphur, on being burnt in the presence of an excess of air, is oxidized into sulphur dioxide (SO_2). This is further oxidized by nitric acid—given off by the decomposition of soda—into sulphur trioxide (SO_3); and this is hydrated in the chamber by steam into sulphuric acid (H_2SO_4).

The arrangement of the Sheffield Gas Company's chemical works may not be all that could be desired, but it is one for which the author is not responsible; and no doubt the exigencies of the site largely influenced his predecessor in their design.

Steam is obtained from two 30 feet by 7 ft. 6 in. Lancashire boilers, fitted with furnaces for burning refuse coke screenings. There are two of Messrs. C. & W. Walker's sulphate stills, each capable of distilling 90 tons of liquor per diem, and having liquor-heaters, lime-pumps and saturators, &c., complete for each. The liquor is first heated by passing through a coil of pipes laid within an old boiler situated outside the building, into which the waste liquor is run on its way to the open coolers, where it is reduced to a temperature of 100° Fahr. before passing into the sewers. The ammoniacal liquor is further heated, before entering the stills, to about 160° Fahr. by the hot gases leaving the saturators. The heat of these gases, after being partially utilized in this manner, is further used for raising the temperature of the feed-water to the steam-boilers.

In the first set of condensers are fixed coils of 3-inch diameter steam-pipe; and through these the feed water is pumped and raised to a temperature of from 190° to 200° Fahr. A second set of condensers is provided; and a small stream of cold water is run through them as required, to ensure the gases being thoroughly cooled. These then pass through scrubbers, consisting of two 30-inch diameter pipes filled with coke, and from them to the oxide burners, where the sulphuretted hydrogen (H_2S) is burned to sulphur dioxide (SO_2).

The spent oxide burners are of the shelf pattern, and consist of six sets; each set having four shelves upon which the oxide to be burnt is placed. They are built of Buckley blue fire-brick, obtained from Hawarden, in North Wales. This material is very suitable for the purpose—being harder and more durable than that from Stourbridge; and though it will not stand the heat required for gas-retorts, it resists well a temperature of about 1500° Fahr., which is the highest needed for burning spent oxide. The number of sets may be varied to suit the capacity of plant required; but the six in use at Sheffield will burn off 4 tons of the spent oxide per diem, in addition to the sulphuretted hydrogen evolved from 180 tons of liquor.

In the first instance, the burners are heated by wood fires, lighted upon the shelves; and afterwards, when thoroughly dried, coke is used until a dull red heat is obtained, after which the heat is maintained by the burning sulphur from the spent oxide. The time required for heating up with wood and coke is about a week, or rather longer with newly-built kilns. While heating up, the pipe to the Glover tower is blocked up with a temporary sheet-iron chimney, placed upon the main flue leaving the burners. About 3½ cwt. of oxide is the charge for each shelf, and this is burnt off in 24 hours, so that one shelf is re-charged each hour. At the same time the shelf next to be charged has the burnt oxide pushed about half-way to the back or hottest part of the shelf; and the charges upon the next two shelves are also stirred up by running an iron slicer underneath and through them.

The charge, when burnt off, is pushed through an opening in the back of the shelf, and falls upon a slide or damper, lying there to cool for several hours, or until the next shelf in the set has to be recharged, when the slide is drawn, and it drops, still enclosed, upon the floor of the sunk chamber. Here it is slaked with water, and can then be shovelled out without inconvenience. Anyone who has witnessed a charge drawn red hot through the front by the usual method, and seen the coughing and choking which attack the spectator consequent upon the escape of sulphurous fumes into the open air, will easily appreciate the improvement effected by pushing the burnt charge through the back as described.

A sample of the burnt oxide is taken just before the charge is pushed upon the slide. These samples are put together, re-sampled, and analyzed once a week. The average weekly sample should not contain more than 4 per cent. of free sulphur in the dry burnt oxide (equal to about 1 per cent. in the original spent). Should it be higher, the remedy is to stir more frequently.

Flues are constructed above and below the shelves of the burners, along which the sulphurous gases pass in their conversion to sulphurous anhydride (SO_2). Those from the two lower shelves drop downwards at the back, and then pass to and fro along the flues under the bottom shelf; rising again at the back, and meeting the gases from the two upper shelves, along with which they pass to and fro through similar flues over the top shelf, and thence into the main flue. The sulphuretted hydrogen from the saturators is admitted into the flue above the top shelf—a stopcock being provided for each pipe, which is closed just before a shelf in the set to which it is attached is charged, and opened again one hour afterwards.

It is very important that the sulphuretted hydrogen should be quite cold on reaching the oxide burners. If warm, deleterious organic substances which would otherwise be condensed, are passed forward; and, on burning, they oxidize themselves at the expense of the nitrous compounds, and upset very considerably the working of the chambers.

In addition to sulphur, nitric acid is required for the formation of sulphuric acid; and this is obtained from the decomposition of nitrate of soda in cast-iron pots, which are fixed in a chamber adjoining the burners. The pots are kept hot by allowing a portion of the gases from the burners to pass around them; their temperature being easily regulated by dampers allowing more or less of the hot gases to come into contact with them.

In starting a sulphuric acid plant, it is advisable to use at first as much nitrate of soda hourly as the pots can conveniently work, which will be about 10 per cent. of the total free sulphur in the spent oxide; the limit being the amount of heat available. Sufficient acid is added to the nitre to render it fluid; the pots being charged alternately until one is nearly full, when the second is charged for about two hours consecutively, so as to enable the first one to work off. Its contents are then run into a cast-iron pan and allowed to cool, when the contents are broken up and wheeled away. If, on thrusting an iron bar through the hopper into the nitre cake, nitrous fumes are not given off, it may be concluded that the nitre is thoroughly spent. If, when run off, small pieces of nitre are found undecomposed, it may be taken as indicating either that there is insufficient heat, or that the pot has not been allowed to run long enough since it was last charged. If the nitre is too thick, and difficulty is experienced in running it off, it

* After writing his paper, the author heard that Mr. Hepworth had abandoned the method of manufacture recommended by him in his Gas Institute paper, and practically adopted that described by the author.

indicates either that the heat has been allowed to get too high, or that an insufficiency of acid has been used.

From the burners, the sulphurous and nitrous gases pass forward—first through the Glover (or hot) tower; then through the large leaden chambers; and finally through the Gay Lussac (or cold) tower. The Glover tower is 30 feet high and 9 feet square, and is constructed of a strong framework of timber lined with 12 lb. lead. The bottom consists of a tray, formed of 40 lb. lead, resting upon a brick foundation. The sides are sealed in acid on the tray. It is packed inside with a chequerwork of hard vitrified bricks. It may be said to answer two purposes: (1) concentrating the weak chamber acid by evaporation of a portion of its water; and (2) denitrating the strong acid that has been run down the Gay Lussac tower.

The chambers are formed of light timber framing of sufficient strength to carry the weight of the 7 lb. sheet lead top and sides. The bottom of each is formed of sheet lead resting upon close boarding; the lead being turned up to form a shallow tank, in which the acid is deposited as made, and into which the lead sides are sealed. The whole of the chambers are supported upon brick arches; or, if it should be preferred, they may be carried on light brick piers. By far the greatest portion of the acid is deposited in the chambers, the area of which should bear a certain proportion to the quantity of sulphur burned. The capacity usually recommended is about 20 cubic feet per pound of sulphur per 24 hours; but at Sheffield the best results are obtained when the area of chamber space is increased to 30 cubic feet. At Sheffield, the Gay Lussac tower is of similar size to the Glover tower; but it is more usual to make it somewhat higher. It is packed with hard furnace coke, and is used for absorbing the last traces of nitre and sulphur.

When re-starting an acid plant, it is necessary, just before the gases from the burners are turned through the Glover tower, to run down it a small stream of acid, in order to prevent overheating. When working regularly, and under normal conditions, the quantity run down each 24 hours is about 9 tons (six eggs) of acid that has been through the Gay Lussac tower, having a strength of about 148° to 150° Twaddel, and about 3 tons (two eggs) of acid from the last chamber. The whole of this acid should leave the base of the tower at about 150° Twaddel; and the temperature of it should range from 250° to 300° Fahr. before cooling, and from 60° to 70° Fahr. afterwards. The coolers consist of two circular leaden tanks, about 2 ft. 6 in. diameter and 3 ft. 6 in. deep, containing coils of 1½-inch pipe, through which cold water is continually running. Once or twice a fortnight the tower should be flushed for three or four hours with as much acid as the overflow at the base will take, in order to prevent any choking. During flushing, the proportion of chamber acid to tower acid is considerably increased. The strong acid containing the nitre absorbed in passing down the Gay Lussac tower is stored in separate tanks, and only mixes with the chamber acid as this runs into the distributors on the tower, so as to prevent the loss of nitre which would otherwise occur.

It is important that the chamber should always contain sufficient nitrous gases. This may be judged in three ways: (1) Colour of the gases as seen in the daytime through the propagating glasses fixed on top of each chamber (except the first), and at night through windows in the sides illuminated by gas lights. In normal working, the gases in the first chamber are always white; in the second, slightly orange; in the third, rather deeper orange; and in the last, deeper still. (2) The amount of nitrous gases present in the acid leaving the Gay Lussac tower, which should be equal to about 8 or 9 c.c. of nitric oxide per cubic centimetre of acid. (3) The test of the exit gases into the chimney, which, under the Alkali Works Regulation Acts, must not exceed 4 grains acidity (estimated as SO_3) per cubic foot of gas. But, in good working, 2 grains should rarely be exceeded; and it would usually range from 0·5 to 1 grain.

Should the colour of the gases in the chambers be too pale, or the quantity of nitrous gases in the acid leaving the Gay Lussac tower fall much below 8 c.c., or the exit test be too high, additional nitre must be used, and *vice versâ*.

The air required for burning the oxide and sulphuretted hydrogen, and for absorption of the nitrous gases in the chambers, is admitted through the fronts of the burners. The exit damper should be so regulated that there is a gentle pull in at the front of these; and a test of the exit gases should show 8 to 10 per cent. of free oxygen. Insufficient air would cause imperfect combustion of sulphur and loss of nitrous gases through imperfect oxidation, while too much air would be waste of chamber space and loss of gases through excessive draught on the exit.

The quantity of steam required in the chambers is shown by the specific gravity of the acid made, as indicated by the drips; and it depends very much upon the amount of moisture in the spent oxide, the quantity of acid concentrated by the Glover tower, and the quantity of sulphuretted hydrogen burnt. It will not often be necessary to put steam into the first chamber; but should the strength of acid from the drips rise above about 130° Twaddel, it must be reduced by the addition of steam. The drips in No. 2 chamber should range from 120° to 130° Twaddel; in No. 3, from 110° to 120° Twaddel; and in No. 4, from 105° to 115° Twaddel. The power of the acid running down the Gay Lussac tower to absorb nitre depends very much on its strength and temperature. It should be not less than 150° Twaddel strength, nor hotter than 70° Fahr.

The "eggs" mentioned are of cast iron, and situated below the ground-level; so that acid from any of the store tanks or chambers can be run into them, and forced up into the tower or saturator tanks by air pressure obtained from a blowing-engine.

The quantity of acid produced is easily varied according to the make of sulphate. For two or three months in the winter, both sulphate stills are in use—producing 80 tons of salt a week. During this time, the burners are charged to their full capacity with 4 tons of spent oxide a day—producing the required quantity of acid for the sulphate made. During the remainder of the year, one sulphate still only is at work; and the charges of oxide in the burners are reduced by one-half.

Both sulphate and acid plant are equal to an annual production of 3000 tons of sulphate; though, up to now, 2341 tons is the most that has been made in one year. The acid plant described could, at the present prices of lead, be erected complete for £5000 to £6000.

The labour, when working the acid plant at its full capacity, consists of three process men—one for each shift of eight hours—and a labourer in the daytime, who wheels up the spent oxide and takes away the burnt.

During the year ended June last, 1977 tons of acid, calculated to 148° Twaddel strength, were made, of which the following table gives the details of cost of manufacture, exclusive of repairs. These being exceptionally light, an average of four years is taken :—

	Amount.		Per Ton of Acid.
1023 tons of spent oxide, 45 per cent. sulphur, at 5¼d. per unit	£1023 0 0	..	10s. 4·2d.
49½ tons of nitrate of soda	445 13 0	..	4 6·1
342½ tons of coke screenings for fuel	46 7 5	..	0 5·6
Wages for labour in manufacture	291 2 5	..	2 11·3
Repairs and renewals of plant, being an average for four years	602 1 8	..	6 1·1
	£2408 4 6	..	24s. 4·3d.
Add 5 per cent. interest on £6000, the estimated cost of plant	300 0 0	..	3 0·4
Total	£2708 4 6	..	27s. 4·7d.

Thus, for the period at present under review, the cost of 148° Twaddel acid, including interest on capital outlay, was less than 27s. 6d. per ton. For the sake of comparison, however, it is considered better to state the cost of the acid at an amount per ton of sulphate made, as the quantity used may vary according to strength and quality. During the same period, 2144 tons of sulphate were produced, and 1895 tons of 148° Twaddel acid were used in its manufacture, which, at the above price of 27s. 6d. per ton, is equal to a cost for acid of 24s. 4d. per ton of sulphate made. This low cost for acid is partly attributable to the utilization of the sulphuretted hydrogen obtained in the distillation of the ammoniacal liquor. The sulphur from this source is practically about one-fifth of the whole quantity required for the acid made.

It will be seen from the foregoing table that, during the year, 1023 tons of spent oxide were burnt, containing 45 per cent. of sulphur, or 460 tons of actual sulphur. During the same period, 32,549 tons of ammoniacal liquor were distilled, containing an average of 0·55 per cent. of sulphuretted hydrogen, or about 191 tons of sulphur, or 29 per cent. of the total sulphur available. As, however, some of this is necessarily lost by combination with the lime used in the stills to liberate fixed ammonia, and some also passes

away with the condensed water, it is found in practice to represent, as stated, about 20 per cent. of the total sulphur burned. This means that, if the sulphuretted hydrogen were not thus utilized, about 255 tons more of the spent oxide would have to be used, at an increased cost of £255. To this, however, must be added interest on the outlay for purifiers or Claus plant. The cost of either could not be less than £1500, representing a cost for interest, at 5 per cent., of £75 a year, or a total saving of at least £330 a year. In other words, the value of the sulphuretted hydrogen provides a sum more than sufficient to pay 5 per cent. interest on all the outlay required for complete sulphuric acid plant.

Whether the manufacture of sulphuric acid can be profitably adopted must, of course, to some degree, depend upon local circumstances. But there can be no objection to its adoption on the grounds of nuisance; as from this it is entirely free. Moreover, the manufacture is simple; and the author hopes he has proved it to be economical also. Mr. Hepworth showed that, in Carlisle—where 15,000 tons of coal a year were being carbonized—acid manufacture was profitable; and the author can unhesitatingly recommend it where works approach in size those of the Sheffield Gas Company.

In conclusion, the author desires to acknowledge the assistance he has received, in the preparation of this paper, from Mr. G. T. Calvert, the Superintendent of the Sheffield Gas Company's chemical works.

Discussion.

The PRESIDENT said he thought the members would highly appreciate this paper. It was extremely difficult for outsiders to get any information with regard to the working of chemical operations. When the manufacture of such an important product as sulphuric acid was in operation at a works like those of the Sheffield Company, it gave an opportunity of which Mr. Stevenson had availed himself, and the benefit of which he had now given to the members. From what he had stated, they could now judge of the extent to which it would be worth while for gas undertakings to take up this manufacture. It was really an important matter when it was considered how important sulphuric acid was for the profitable working up of sulphate from gas liquor.

Mr. LEWIS T. WRIGHT (London) said he had had some experience with the manufacture of sulphuric acid on somewhat the same scale as appeared to obtain in Sheffield. Mr. Stevenson had rendered a distinct service to the Institution by bringing this matter so ably before them, as such papers were rare. One of the criteria of success in acid making was the consumption of nitre; and he was rather struck by the large amount of nitre which appeared to be consumed at Sheffield. In a works able to choose its supply of sulphur material—and this was not the case at Sheffield—3 per cent. of nitre on the sulphur charged was considered to be good working; but in this case the consumption was 9·2 per cent., which was rather large. Of course, they knew that the gas which came away from the saturators was not as pure as it might be. In addition to containing carbonic acid, which was not a useful diluent, in the acid chamber it contained organic compounds, which Mr. Stevenson had referred to; and it was commonly supposed that the use of these gases in the saturators necessitated an increased quantity of nitre. Again, it was believed that spent oxide contained bodies which also called for a greater consumption of nitre. But having worked with both the gases from the saturator and spent oxide, and having been able to produce sulphuric acid with a very much less consumption of nitre, he should have thought probably that there might be some other cause, though perhaps in this case the spent oxide was not particularly pure. The amount of sulphur, as calculated from the sulphuric acid, would be 539 tons; and the amount calculated from the spent oxide (deducting 4 per cent. said to be left in the residue) was 419 tons—leaving 120 tons as the sulphur provided by the waste gas from the saturators, or 22 per cent. It would be interesting if any gentleman who had the opportunity of studying the action of this sulphuric acid plant could experiment, and see what was the increased consumption of nitre due to the gases which came from the saturator. It might be that the economy was not so great as it appeared. There was unquestionably an economy in this case, resulting in 120 tons of sulphur; but it might be that the use of these gases from the saturator was attended with the increased quantity of nitre consumed, and would somewhat discount the economy. Possibly this matter might not have escaped Mr. Stevenson's attention; and, if so, he should be glad to know if the large amount of nitre was to be attributed to the spent oxide or to the waste gases.

Mr. B. W. SMITH (Smethwick) asked how it was that the sulphur was charged at 5⅛d. per unit; while the oxide was only 45 per cent.? This was a low percentage; and 5⅛d. seemed an exceedingly high rate.

Mr. S. GLOVER (St. Helens), having had some experience in the works referred to, had been much interested in the paper. They must all feel that the best use had been made of the site, in arranging the different operations and chambers shown on the diagram. Turning this question over in his mind, he was wondering what was the smallest gas-works at which it would be profitable to make sulphuric acid. Of course, the possibility of making sulphuric acid depended upon the method of purification adopted. In works where lime was used for purification exclusively, it would be impossible to use the spent material for acid making; and even if oxide was adopted entirely for purification, the question was, in what sized works would it be profitable. At Sheffield, where the make of sulphur and spent oxide was considerable (much larger than at many works), the profit was very small, he should think, compared with the price at which acid could be bought, which in some towns was about 26s. a ton for manufacturing sulphate of ammonia, or in towns like Carlisle, at a distance from the chemical-works, acid could be bought at 32s.

Mr. STEVENSON asked what kind of acid Mr. Glover referred to?

Mr. GLOVER said pyrites 144°. For a works making 200 tons of sulphate a year, or a works making about 200 million feet of gas, if the saving was taken at 8s. per ton, it would only amount to £80, assuming that the manufacture could be conducted as economically as at Sheffield. To effect so small a saving, few engineers would undertake the responsibility of putting down a plant to manufacture sulphuric acid. With reference to the size of the apparatus, the chamber space recommended was greater than that usually allowed; and for smaller works the area would have to be much larger in proportion, which would increase the cost of the plant. Again, it would not be advisable to have works of this kind unless sufficient chemical assistance was provided. Frequent tests were necessary of the materials, waste gases, and the acid, in order to prevent excessive wear of the plant, which might easily be brought about by the carelessness of the men.

Mr. T. HOLGATE (Halifax) said it was a very important question whether it was desirable to make sulphuric acid, or to convert the sulphur to brimstone. When Chance's sulphur-recovery process was introduced, a good many chemical manufacturers preferred to burn sulphuretted hydrogen into brimstone, knowing they could make their acid from pyrites, which could be obtained at much less cost. He was informed by manufacturers of acid that they had now no difficulty in getting pyrites free from arsenic; so that the principal difficulty was removed, and that being so, he thought each case would have to be considered on its own merits—whether it would be more profitable to make brimstone or acid. A wider view might be taken of this subject; and that was the one adopted by M. de Lachomette, the Engineer to the Lyons Gas Company. He attempted to make sulphate of ammonia direct, by the combustion of sulphur into sulphur dioxide causing it to unite with ammonia—first making ammonium sulphite, and then oxidizing that by a blast of air into sulphate. He believed that his experiments were successful to some extent; but the final difficulty appeared to be in the perfect oxidation of the sulphite. It would be unwise to dismiss this problem, because there seemed to be a possibility of causing a direct union of the kind to be accomplished by an action similar to that which took place in the Referees' sulphur test. They had there ammonia brought into contact with sulphur dioxide; and a current of air in the chimney seemed to oxidize fairly well the sulphur dioxide into sulphur trioxide, and then what they received into the condenser was sulphate of ammonia.

Mr. FLETCHER STEVENSON, in replying, after thanking

Mr. Wright for his kind remarks, said he must admit the percentage of nitre used was high. He knew many works where it was lower; and he thought they would be able to reduce it considerably at Sheffield, though whether they would get it down to 3 per cent. he could not say. That the gas from the saturators did not affect this, he was quite certain. When he first of all went to Sheffield, the gases were not burnt for sulphuretted hydrogen; and they used a larger quantity of nitre than they did now. Another gentleman remarked that he charged sulphur at a very high rate; but that was the price delivered into their works. Of course, they produced it themselves; but it was delivered into the chemical works, and charged no doubt at a price slightly above that for which it could actually be purchased. He preferred to charge it too high than too low. If they charged less, the cost of the acid would come out proportionately less. Mr. Glover said pyrites acid could be bought at 27s. 6d., which was practically the price he had given for oxide acid. He was quite certain that most engineers who had had experience of both pyrites and oxide acid would agree with him that they would never go back to pyrites acid if they could get oxide acid at the same price—that is, if the arsenic were left in which gave rise to a great deal of trouble and annoyance; and to get rid of the arsenic meant extra cost. He was told that, in the Warrington district, the cost of taking out the arsenic was about 7s. 6d. a ton, 148° Twaddel. That was the actual quotation to a gas-works for a year's supply. Mr. Holgate raised the question whether it would not be better to convert sulphur from the oxide into brimstone and make the acid from pyrites; but, as he had pointed out in the paper, this would involve expenditure for plant which, with the process he had described, was altogether unnecessary. Moreover at Sheffield, as the works were cramped, it would be very difficult indeed to find accommodation for a Claus kiln.

PURIFIED AMMONIACAL LIQUOR, AND ITS USE IN GAS PURIFICATION.

By T. Holgate.

The advantages to be obtained from the use of purified ammoniacal liquor are so obvious, that little apology appears to be necessary in again bringing forward the subject. The previous attempts, as exemplified in the process of Mr. A. F. Hills, and in that of Mr. C. F. Claus, have not generally been regarded as wholly successful, though the former has for many years been used at the Old Kent Road works of the South Metropolitan Gas Company.* The features in them which appear unsatisfactory are: (1) The loss of ammonia, (2) the costly nature of the plant, (3) the great care required in working.

The aim of the author has been to obtain these advantages by a simple method, while avoiding the drawbacks above mentioned; and to describe such method is the object of this paper. The principle of its operation is that already well known—namely, the heating of ammoniacal liquor to a temperature of about 200° Fahr., whereby the greater part of the carbonic acid and sulphuretted hydrogen is driven off, while the bulk of the ammonia is retained. The gases thus driven off are passed into a saturator, such as is used in the manufacture of sulphate of ammonia, the ammonia is absorbed by acid, while the sulphuretted hydrogen and the carbon dioxide together with the steam, pass into the ammoniacal liquor heater, and thence into an oxide of iron purifier, Claus kiln, or sulphuric acid plant. The heating of the ammoniacal liquor may be effected by a separate source of heat, preferably live or exhaust steam, or by the waste gases from a sulphate of ammonia plant, which latter plan has been adopted in the plant designed and worked by the author. The following is a description of its construction and mode of working.

The hot waste gases from the saturator pass through a 12-inch pipe, and enter at A the upper half of a vertically placed vessel—diagram No. 2, fig. 1 [see next page]—and flow downwards to the base of the tower, passing thence at F to a condenser for further cooling, and on to the Claus kiln. This tower contains within it two coils of pipe—one long and one short—through which flows the ammoniacal liquor undergoing purification. The liquor enters at the bottom of each coil, and emerges at the top (B) upon a series of trays, in a compartment which communicates by means of an 8-inch pipe with another leading to the saturator from the sulphate still. The gases driven off are returned, after abstraction of the ammonia they contain, to give up their heat upon the outside of the coils through which the streams of liquor are flowing from which they emanate.

The ammoniacal liquor, which has been deprived of the greater part of its sulphuretted hydrogen and carbonic acid, passes at C from the bottom of the upper compartment of tower No. 1 into the lower half of the vessel shown on diagram No. 2 as tower No. 2, at the point marked D. Inside this part of tower No. 2 is a third coil of pipes, through which the second stream of ammoniacal liquor undergoing purification passes. This impure liquor receives its first heating from the hot purified liquor which is passing to the washer; and on emerging from tower No. 2, this second stream flows through the short coil already mentioned in tower No. 1—entering the latter at E. The heating of the impure ammoniacal liquor in tower No. 2 at the same time effects the cooling to a considerable extent of the purified liquor. To more efficiently cool the latter, it must be passed through a tubular water or other condenser, or through a series of vertical cast-iron pipes, as at the Halifax Gas-Works. The quantity of liquor flowing through each of the coils is most easily regulated by valves; and thus the required temperature of the liquor flowing on to the trays is obtained without difficulty. The upper part of tower No. 2 receives the partially cooled purified liquor from the base of tower No. 1, and serves as a store for the liquor flowing to the washer.

The plant described has been in operation since November, 1893; and, though it has been worked under unfavourable circumstances, it has proved of great value, while it has revealed still greater possibilities of usefulness when additional washers and scrubbers are employed. The quantity of liquor converted into sulphate has been about 9000 gallons per day; and of liquor purified, about 36,000 gallons per day. The following are tests of the liquor before and after purification:—

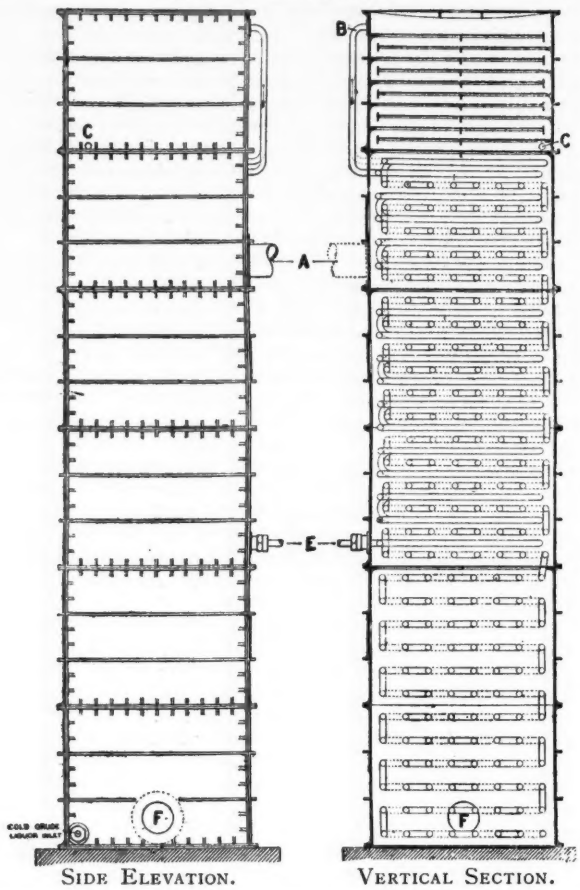
Before Purification.					After Purification.					Impurities Removed, per Cent.				
Density.	NH_3.	CO_2.	H_2S.	Total.	Density.	NH_3.	CO_2.	H_2S.	Total.	Reduction in Density.	NH_3.	CO_2.	H_2S.	Total.
3·5° T.	1·343	..	..	1·760	1·50° T.	0·986	..	..	0·528	2·00° T.	26·5	..	..	70·0
4·0° T.	1·327	..	..	1·554	1·75° T.	1·053	..	..	0·546	2·25° T.	20·6	..	..	65·0
4·0° T.	1·360	2·18	0·50	2·680	2·00° T.	1·130	0·99	0·08	1·070	2·00° T.	16·9	54·5	84·0	60·0

The tests of gas contained in the following table [see next page] show the effect of washing with unpurified and purified liquor in a washer, 10 feet by 12 feet by 20 feet, having seven seals, each 1½ inches deep, at No. 2 works. These tests are confirmed by the estimation of carbonic acid made at the inlet of the lime purifiers. When using the same class of coals, and with the same quantity of gas passing per hour, the percentage of carbonic acid present at the inlet of the washer was 3·706. After passing through the washer and a Laycock rotary scrubber supplied with clean water, the carbonic acid at the inlet to the lime boxes was, with unpurified liquor, 3·154 per cent.; and with purified liquor, 2·097 per cent.—a reduction of 14·9 and 43·4 per cent. respectively.

After passing through the washer at No. 2 works, the purified liquor is capable of removing a large percentage of impurities from gas, and ought to be passed through a further series of washers and scrubbers. To a certain

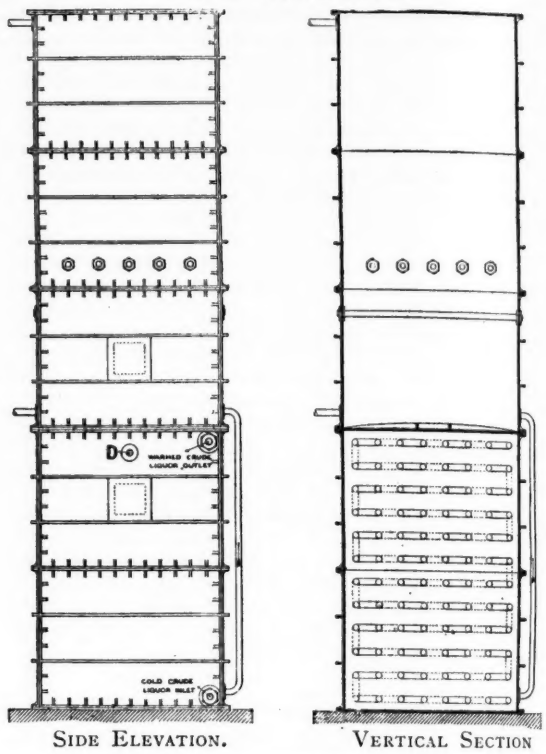
* The author would here express his appreciation of the work done by Mr. G. Livesey, Mr. F. Livesey, Mr. Hammond, and others, in showing the benefits to be obtained by the use of purified ammoniacal liquor.

FIG. 1.—TOWER NO. 1.



SIDE ELEVATION. VERTICAL SECTION.

FIG. 2.—TOWER NO. 2.



SIDE ELEVATION. VERTICAL SECTION

TABLE SHOWING THE EFFECT OF WASHING WITH UNPURIFIED AND PURIFIED LIQUOR.

—	Unpurified Liquor Used.			Purified Liquor Used.		
	CO_2.	H_2S.	Total.	CO_2.	H_2S.	Total.
Inlet gas . .	3·374	1·660	5·034	2·748	1·425	4·173
Outlet gas .	2·796	1·428	4·224	1·687	0·825	2·512
Difference .	0·578	0·232	0·810	1·061	0·600	1·661
Do. per cent.	17·130	14·000	16·100	38·600	42·100	39·800
Liquor used .	At 73° Fahr. raised from 4½° to 5½° Twaddel.			At 82° Fahr. raised from 1½° to 2¼° Twaddel.		
Gas passed .	64,000 cubic feet per hour at 58° Fahr.			68,000 cubic feet per hour at 62° Fahr.		

extent, this has been done since December, 1894, by pumping it through a tower scrubber at No. 1 works. The following test shows its efficacy when gas heavily charged with carbonic acid was passing at a comparatively slow rate (7000 cubic feet per hour) through a tower scrubber, 12 feet in diameter and 60 feet high, or of 6785 cubic feet capacity; the liquor entering at 2¼° and emerging at 3° Twaddel:—

	CO_2		H_2S.		Total.
Inlet gas	8·410	..	0·914	..	9·324
Outlet gas	1·277	..	1·092	..	2·369
Difference. . . .	7·133	..	0·178	..	6·955
Do. per cent. .	84·820	..	19·480	..	74·590

These tests of the gas are confirmed by comparing the number of changes of lime and oxide purifiers when the two classes of ammoniacal liquor are used, and also by the weight of lime employed during the year, the wages for purification, and the production of brimstone. Before entering upon these particulars, the author must explain that during the year ended March 31, 1895, the plant was in operation for a period of 177 days, and the purified liquor was used for only once washing 300 million cubic feet of gas at the No. 2 works, and, as already mentioned, to act upon 56 million cubic feet at No. 1 works of the Corporation.

STATEMENT OF LIME AND OXIDE BOXES CHANGED.

(1) *When Washing Gas with Unpurified Liquor.*

Works.	No. of Changes.		Gas Passed in Thousands.	No. of Days.	Gas Passed, in Thousands.		
	Oxide.	Lime.			Per Day.	Per Change.	
						Oxide.	Lime.
No. 1 . .	2	8	10,521	27	390	5,260	1,315 (*a*)
No. 2 . .	18	14	93,914	51	1841	5,217	6,708 (*b*)
Total .	20	22	104,435	..	..	5,222	4,747

(2) *When Washing Gas with Purified Liquor.*

Works.	No. of Changes.		Gas Passed, in Thousands.	No. of Days.	Gas Passed, in Thousands.		
	Oxide.	Lime.			Per Day.	Per Change.	
						Oxide.	Lime.
No. 1 . .	9	12	47,771	74	646	5,308	3,906 (*c*)
No. 2 . .	18	26	219,010	112	1955	12,167	8,416 (*d*)
Total. .	27	38	266,781	..	..	9,881	7,021

NOTES.—(*a*) From Feb. 28 to March 27, 1895; (*b*) from Nov. 25 to Dec. 19, 1894, and Feb. 28 to March 27, 1895; (*c*) from Jan. 1 to Feb. 28, and March 27 to April 11, 1895; (*d*) from Nov. 6 to 25, 1894; from Dec. 19, 1894, to Feb. 28, 1895; and from March 27 to April 18, 1895.

The figures following are for the financial year ended March 31, 1895, as compared with the year ended March 31, 1893, when unpurified liquor only was in use. There have been two disturbances from perfectly parallel conditions; and while the precise effect of these cannot be assessed, one would make in 1894-5 a slight reduction in labour, while the other would add in 1894-5 to the lime required. Taking the total result, the author regards it as a close approximation to the gain derived from the use of the purified liquor, under the conditions before mentioned, and with prices for materials and labour now in force.

Statement of One Year's Working to March 31, 1895.

Sulphate of ammonia made, 816 tons; estimated to yield in Claus kiln, 17 tons of brimstone; total yield of brimstone, 67 tons, from which 17 tons are to be deducted, giving 50 tons as due to the action of the purified liquor. The sulphur, if sold as spent oxide, is estimated to have realized 16s. per ton in excess of the cost of the oxide; equal to a sum of £40. The following figures show the gain from the use of purified liquor:—

50 tons of brimstone, at £3 = £150, less £40 . .	£110	0	0
Saving in lime, 297 tons, at 12s. 6d. per ton . .	185	12	6
Saving in wages for purification	479	3	3
Total	£774	15	9

or equal to £4 7s. 6d. per day for the 177 days' working.

The cost of that portion of the plant which purifies the liquor, cools it, and delivers it to the washer, including the share of the Claus kiln, was about £1000; and, after deducting interest, the profits during the past eighteen months have recouped that expenditure.

The thanks of the author are here recorded as due to his assistant, Mr. Alfred J. Hope, for the care exercised in performing most of the analyses mentioned in this paper.

Discussion.

The PRESIDENT said it was very satisfactory to find that this question of purification by liquor was not being overlooked. The innovation described by Mr. Holgate consisted in this, that he had used the Hills's process in conjunction with sulphate manufacture; and, by this very simple means, he got over what used to be one of the difficulties of that process—the loss of ammonia. He could also, by an arrangement for raising the temperature of the liquor to be dealt with, effect, he should think, considerable saving in the fuel used for evaporation.

Mr. C. GANDON (Lower Sydenham) said he had not been able to quite follow the process, though he had no doubt there was a great deal in it. Of course, Hills's process anticipated that portion of it which utilized the purified liquor for removing impurities from gas; and it had always been a source of wonder to him that this had not been more used. It might be asked why he did not use it himself. The reason was that it took up a great deal of room for the necessary apparatus to cool the liquor after it had been heated; and for this reason he had not been able to see his way to use it. Whether the modification would enable it to be more easily applied, he could hardly judge from the small diagram shown by the author. One thing which struck him was that, in the production of 816 tons of sulphate of ammonia, the estimate was given of only 17 tons of brimstone recovered by the Claus kiln. They had one at work for some years, dealing with the foul gas after the ammonia had been removed; and they obtained a much larger yield than that. He thought the make of sulphate would be about 600 tons a year, from which they would get about 30 tons of brimstone from the Claus kiln. He might add that it was a most useful apparatus. Before introducing it, they had continual trouble in disposing of the foul gases, and were at loggerheads with the Alkali Inspectors; but since then they had no trouble. The Claus kiln could only be used with a continuous working sulphur plant; with an intermittent system, he did not think it would answer.

Mr. J. W. HELPS (Croydon) said he could bear out what Mr. Gandon had said with regard to the Claus process, that the estimate given by Mr. Holgate concerning the amount of sulphur obtained from the foul gas was a low one. Mr. Holgate estimated it at £3 per ton for the brimstone produced. He had a small parcel of sulphur that he was trying to dispose of; and the highest price offered was 30s. in London. But it might be more valuable in the North. Mr. Holgate seemed to claim a large saving in the use of this purified liquor, even in the rather limited extent to which it was used, amounting altogether in the course of the year to £774. He did not know how much coal carbonized that represented; but it appeared to him that it would be something like 80,000 tons per annum. It was difficult to thoroughly follow from so small a diagram the exact working. But he thought that, even if the estimates given could be borne out in practical working to anything like this extent, the process must be one which would be of great benefit to gas companies; and their thanks were due to Mr. Holgate for introducing it.

Mr. GANDON said he had intended to refer to the price of sulphur. Some six months ago, they sold a parcel for 50s. a ton. Whether the price had gone down since, he did not know.

Mr. LEWIS T. WRIGHT said that some years ago Mr. King asked him to contribute some articles on this subject to the JOURNAL OF GAS LIGHTING;* and the articles he contributed were really based on the experiments he was then making on a somewhat similar process to that now described. Mr. Holgate had scored this time, because he (Mr. Wright) was not able to apply this process in connection with sulphate making, as he had suggested, in the articles referred to, should be done, and thus get over the great trouble which all people used to working with revivified liquor must have felt. Mr. Holgate was now able, by combining the operations of the gas-works and the sulphate-works, to use the process. From his own experiments, he could quite well understand all that Mr. Holgate had done. Not having the data with him, he could not give off-hand the actual results that he had obtained; but by pushing the process a little further than Mr. Holgate did, he was able to reduce the quantity of carbonic acid a great deal more. If he did not misunderstand the paper, it would appear that the liquor was revivified four times, because Mr. Holgate said the quantity converted into sulphate per day was about 9000 gallons, and the quantity of liquor purified was 36,500 gallons. From this, he judged the same liquor had been circulated through the apparatus four times. As the result of this continual revivification of the liquor, the strength had been brought down from 5½° to 1½° Twaddel. It was rather an objection to this process, that, in the course of revivification, the ammonia disappeared from the liquor; and it became therefore exceedingly weak. He had also noticed in his own case, that the liquor at last got a "set," and seemed to be unable to do the work that theoretically it should do, according to the amount of ammonia left in it. In his experiments, the liquor was revivified a great many more times than four. He believed that Mr. Holgate had an excellent process; and with the skill he could apply to it, he could develop it into something very useful in places where the sulphate-works were contiguous to the gas-works. Whether it would be successful otherwise, he was rather doubtful.

Mr. METHVEN asked Mr. Wright whether it was to be taken that it was ammonia in the free state which was the actual purifier in the purified liquor; otherwise they might conclude that the loss of ammonia was an absolute loss. Probably it was in a fixed condition, and useless for purposes of revivification. Was that so, or was it necessary that the ammonia should be in a free state?

The PRESIDENT said the impurities were displaced in the process of heating it up.

Mr. METHVEN understood there was a loss of ammonia.

The PRESIDENT remarked that that was in the catch scrubber.

Mr. LEWIS WRIGHT said in the process described by Mr. Holgate—and this was the beauty of it—the ammonia which would in Hills's process have been in the exit gases, and would have to be washed out, was passed through the acid saturator, and immediately converted into sulphate, and was no longer a loss. It was a loss to the liquor, but not to the gas company, because it went into the saturator; and this was really the charm of the process. When he was working on a similar scheme, he had the same idea; and, in his articles referred to, he advocated this idea. But he stuck fast, because he could not deal with the ammonia satisfactorily—his sulphate-works being ten miles away, which made it very inconvenient; and he therefore dropped it. In no case in ordinary gas liquor was ammonia free; it was always combined with some acids—carbonic acid or sulphuretted hydrogen. In the gaseous condition, it might be regarded as entirely free, as a salt of ammonia could not exist in the gaseous condition. In the case of gas liquor heated to a temperature above 180° Fahr., rather less carbonic acid and sulphuretted hydrogen than necessary to saturate the ammonia present were found, and thus there was some free ammonia. At 200° Fahr., there was not enough of the carbonic acid and sulphuretted hydrogen by about 14 per cent. to saturate the ammonia.

Mr. HOLGATE, in reply, again described his apparatus by the aid of a diagram, in order to make it more clear.

* See Vol. XLVIII., pp. 280, 329, 373, 511.

It was, he said, important to point out the fact that the system was not confined to use in conjunction with the sulphate of ammonia plant in the ordinary way of manufacture. If in any large works it was desirable to make purified liquor, they could have a saturator to absorb the ammonia, and make a comparatively small quantity of sulphate. Another question was whether the quantity of sulphate per ton diminished. His experience was that there was no diminution whatever, and therefore no loss of ammonia. The question of the yield of brimstone per ton of sulphate was also raised. The assumption made in the paper, that 17 tons of brimstone would come from a make of 816 tons of sulphate, was based on the figures given him by other gentlemen. He had not used the Claus kiln, except in conjunction with this plant; and therefore he was unable to say definitely the amount which ought to be credited to a sulphate plant pure and simple. But he had communicated with a number of gentlemen who had considerable experience, and found that the quantity of brimstone made in many cases was very small. He had taken the mean of the figures given him in making this estimate. The quantity was entirely determined by the amount of sulphuretted hydrogen in the liquor. As to the price per ton of brimstone, that was the price actually received for a yearly contract; and they were at present obtaining £3 per ton for delivery on the works. He agreed with Mr. Helps that there was a very large reduction in the total cost of purification; and the explanation was this, that their cost for purification was heavy, for which there were two main causes—one that the class of coal used had a very large percentage of carbonic acid; the other, that the purifiers were much too small for the work they had to do.*

The Purification of Water Gas at Belfast.—When dealing last week with the subject of the purification of water gas, in connection with Mr. Broadberry's paper on the installation of plant at Tottenham, we remarked that we were under the impression that, at Belfast, only the sulphuretted hydrogen was taken out by oxide. Mr. Stelfox informs us that, up to the present, he has not commenced the use of oxide at his works; so that both sulphuretted hydrogen and carbonic acid are removed. He states, however, that it is in contemplation, so far as water gas is concerned, to adopt the use of oxide only at an early date.

Presentations to Mr. W. F. Cotton, jun.—Last Tuesday evening, a deputation of the men employed in the different departments of the Alliance and Dublin Gas Company's works, waited on Mr. W. F. Cotton, jun., for the purpose of presenting him, on the occasion of his marriage and the 21st anniversary of his connection with the works, with an illuminated address and a purse of sovereigns, as a token of the respect and esteem in which he is held by the Company's employees. The deputation was most cordially received and hospitably entertained by Mr. Cotton. The presentation was made by Mr. D. Finn, who said that the gift carried with it the heartiest good wishes of all the employees for the future happiness and prosperity of Mr. Cotton, and an assurance that they would always remember with gratitude the great anxiety and interest which he had ever shown for their welfare. Mr. Cotton, in thanking the deputation, requested them to convey to the men his great appreciation of their kindness, with a hope that the relations thus established between them and himself might always continue. Mr. Cotton has also been presented by the staff at the head office, with whom he has been associated for so many years, with a suite of drawing room furniture.

Steel Plate Chimney-Shafts.—Details are given in *Engineering Record* of the construction of brick-lined steel chimneys for the service of the blast-furnace plant of the Maryland Steel Company, which reveals new possibilities for those manufacturers who may require lofty chimney stacks. Two such chimneys were built by the Company named, each of 13 feet internal diameter and 225 feet high. Set upon masonry foundations about 16 feet above the ground, and standing in an exposed situation without guys or bracing, these chimneys are regarded as eminently satisfactory in every respect. The weight of metal in each stack is 77 tons; of brickwork, 900 tons; and of masonry foundation, 1600 tons—making a total deadweight of about 2600 tons, as against 7400 tons, the estimated weight of a masonry and brick stack of the same height and internal dimensions. The stacks are of graceful design—tapering from a wide base, like the trunk of a tree, with an open gallery near the top forming a capital. The foundation was made 40 feet square. The load per square foot of foundation area was therefore 1·62 tons, which has been perfectly borne. The steel plates are $\frac{7}{8}$ inch thick at the base, and $\frac{3}{16}$ inch at the top. The fire-brick lining was 18 inches thick at the base, diminishing, by a half-brick at every 40 feet of altitude, to 4½ inches at the top.

* Mr. Holgate informs us that the purification of gas at Halifax is done without the admission of air or oxygen.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1159.)

THE past week has come and gone—in the Stock Exchange as elsewhere—and many must be glad that it is over, and well over. It opened oppressed with some considerable apprehension that the settlement was going to produce difficulties in the Mining Market; and as that is the "dominant partner" in the House, the mischief might spread no one knew how far. So everything was flat or in suspended animation while the process of settling was watched. But as soon as it was seen that, despite an awkward hitch here and there, it would ravel out all clear, the feeling of relief restored cheerfulness, and prices began to mend apace. The Money Market is quieter than ever, and is likely to remain so, unless lenders are willing to abet a revival of rampant speculation. The Gas Market meanwhile has pursued its own course, going from good to better. Every issue dealt in realized capital prices; and several quotations have advanced—some of them to a considerable extent. In Gaslights, the "A" was scarcely so active as it had been in the week before, but commanded good steady figures. The best price of the week was 275½; and the quotation was raised a couple of points. The secured issues of all descriptions were in good demand, and changed hands at high values; but the only move was an advance in the "C," "D," and "E." South Metropolitans, too, were less active, but very strong, and the "B" was put up to a level 4 per cent. for money price. Commercials, after being left long unnoticed, were at length moved up—the old and the debenture stocks liberally. But the new stock is still left nominally at a more than 4¾ per cent. price. If it were put up to its proper level, perhaps some stock might come into the market. Very little business was marked in Suburbans and Provincials; but they keep on going up, and increase in value every week. The Continental division continue in high favour; and Imperial and Union have made nice advances. Among the rest, Buenos Ayres is the most conspicuous; the Directors' report showing that the process of recovery in the Company's business is making good progress. The Water Companies were rather quiet; and changes are few and slight. The reduction of the Lambeth dividend to 7½ per cent. was anticipated.

The daily operations were: Business in Gas was not very brisk on Monday; and quotations did not move beyond a rise of ¼ in Buenos Ayres. Tuesday was much more active, especially in Gaslight issues. Commercial old rose 4; ditto, new, 2; and debenture, 3; Gaslight "C," "D," and "E," 2; Imperial Continental, 1; and Buenos Ayres, ¼. In Water, West Middlesex gained 1; but Southwark fell 2. Wednesday was a quieter day. Commercial old improved 1; ditto debenture, 2; Continental Union, 2; and Imperial Continental, 1. Further strides were freely made on Thursday. Commercial debenture advanced 3; Gaslight "A," South Metropolitan "B," and Brentford old, 2 each; Imperial Continental, 1; and Buenos Ayres, ¼. Transactions were rather limited on Friday; but Commercial old rose 2 more. Business on Saturday was nearly confined to Imperial Continental, which advanced 1. British improved ½.

ELECTRIC LIGHTING MEMORANDA.

The Period of Repayment for Municipal Electric Lighting Loans—The St. Pancras Theory of Depreciation—Dr. Kennedy on the Electric Lighting of Newcastle—The South Shields Corporation and the Gas Company.

AN important decision in regard to the period of repayment to be fixed for future loans to local authorities for electric lighting purposes has been arrived at by the Treasury, acting in agreement with the London County Council. The matter has been mentioned several times in this column, in connection with the finances of the St. Pancras and Hampstead Vestries' electric lighting undertakings; and the subject has received additional emphasis from the recently expressed determination of the former authority to regard their sinking fund as equivalent to a depreciation allowance. The County Council began by lending money for this purpose repayable in 42 years. But exception to this period was taken by the Treasury, on the ground that it was disproportionate to the life of the plant; and it was proposed, as an alternative, that where the money was intended to be spent upon the more perishable descriptions of machinery and apparatus, repayment should be spread over 20 years. To this limitation the St. Pancras Vestry strongly objected; and the question was further discussed by the County Council and the Treasury, with the result that their Lordships have yielded the point, and consented to the advancement of further electric lighting loans for the original period of 42 years, for the whole initial cost, with the proviso that all plant renewals required during this period should be made out of revenue. This modification of the terms has now been accepted both by the County Council and the Vestry.

The distinction made in the foregoing statement between what the Treasury originally required and what the Vestry are willing to accept, will perhaps appear to be without much difference; but it is something gained to have brought the

Metropolitan and other Local Authorities similarly situated to a sense of their obligation to the ratepayers in the matter of making their electric lighting ventures pay for themselves as they go on. One of the St. Pancras representatives, speaking at the County Council meeting when the subject was discussed, declared that the electric lighting undertaking promised to be a source of great profit; and he pleaded that it should be part of the policy of the Council to encourage local authorities in combatting monopolies. It is easy to perceive what the speaker was driving at; but it is equally obvious that circumstances will have to alter very considerably for the better if parish electric lighting speculations in any part of the Metropolitan area are to become anything else than sources of infinite trouble and great expense to those responsible for them. The St. Pancras venture would stand confessed a sore disappointment to all concerned in launching it, if it were not for the lavish way in which the Vestry itself supports it. Even our electrical contemporaries, while anxious to say a good word for the working of the installation, regarded from the technical standpoint, are unanimous in uttering warnings against the attitude of the Vestry with respect to the serious question of depreciation. We have already given (*ante*, p. 940) a summary of the views of the *Electrician* on this subject; and the *Electrical Review* has followed in much the same strain, "only more so," in its issue for the 17th inst. In this weighty criticism, it is shown that, whereas the repayment of a loan made by the Vestry for 1894 represents a little more than 1½ per cent. on the capital expended, such an allowance is very inadequate to provide for depreciation. Nothing less than 5 per cent., it is contended, should be allowed for the wear and tear of electrical generating machinery. Indeed, even this sum would not suffice for some central station plants; yet "a 5 per cent. depreciation on the St. Pancras machinery would practically mean that, instead of a profit, there would be a considerable deficit on the year's working." The article goes on to assert that, if the Vestry expect their present machinery to last 40 years, they "are acting on a most dangerous assumption." Having regard to the fact that the machinery is likely to wear out, and that great improvements may be necessary before the loans are repaid, our contemporary urges upon the Vestry "the necessity of providing some real reserve." All this cannot be regarded as pleasant reading for the St. Pancras ratepayers.

A most important report has been made by Dr. A. B. W. Kennedy to the Corporation of Newcastle-upon-Tyne, upon the proposed purchase by the Corporation of the undertakings of the two local Electric Lighting Companies. Briefly summarized, this report is not only dead-against the proposal, but constitutes a very weighty piece of evidence against the general proposition as to the advisability of the supply of electric lighting by municipalities. In this case, the charge for current by both Companies is very low; so that the first question Dr. Kennedy had to solve was whether the Corporation could expect to do better. Dr. Kennedy is under no illusions as to the possibilities of municipal administration; and in his report he makes it clear that the only advantages possessed by a local authority over a company consist in the possibilities of raising money more cheaply, and of saving directors' fees. Meanwhile, the capital employed in the business returns an average dividend of 5½ per cent.; and Dr. Kennedy doubts if the Corporation could have done as well as the Companies, supposing the works to have been public property. Finally, it is considered that the whole question, so far as Newcastle is concerned, turns upon the price of the unit, which is at present 4½d. for lighting and 3d. for power. The financial success of the proposed purchase scheme would depend upon the possibility of increasing the charge to the parliamentary maximum of 6d. per unit; and since this is out of the question, the report reluctantly concludes that matters had better remain as they are.

A remarkable illustration of the incompetence of general public statutes to protect private interests when threatened by municipal "Progressivism" is furnished by the proceedings last week of the Police and General Purposes Committee of the House of Commons upon the South Shields Corporation Bill. Notwithstanding the existence of statutory powers for regulating the application of electric traction to tramways, vested in the Board of Trade, it pleased the South Shields Corporation to insert in their Bill clauses enabling them to adopt this principle of tramway working without restrictions of any kind. Naturally, the local Gas Company took alarm at the proposal; and, failing to obtain satisfactory guarantees from the Corporation as to their contemplated proceedings in this regard, they had recourse to the only means of defence open to them, by opposing the Bill. The Corporation failed to show cause to the Committee why they should be exceptionally favoured in this respect; and eventually clauses for the protection of the Company were added to the Bill. It is monstrous that the trouble and expense of a parliamentary contest should be forced upon private interests in this way, while Parliament, in its wisdom, had imagined that general safeguards had been provided for all parties under the Electric Lighting Acts.

The Gas Undertakings Returns, for the year ending Dec. 31 last in the case of Companies, and for the year ending March 25 last in that of Local Authorities, were ordered last Friday to be presented to Parliament in the usual form.

THE LONDON WATER SUPPLY IN THE PAST YEAR.

The report of Dr. Frankland on the chemical, physical, and bacterioscopic examination of the waters supplied by the Metropolitan Companies during the past year, accompanies the Annual Summary of the Registrar-General. Probably it is due to the prominence given at the present time to the question of the London Water Supply by the proceedings in Parliament, that we are indebted for a longer report than usual from Dr. Frankland on this subject. At the outset we are apprised that the "raw material" utilized by the Companies who draw their supplies from rivers was much less favourable for their operations during 1894 than was the case in the previous year. As between one river and the other, the Lea was chemically superior to the Thames; and the former possessed greater purity in its upper as compared with its lower reaches. Exceptions are specified; but generally the raw water of the Lea at Angel Road is considerably better than that of the Thames at Hampton—this being especially the case in times of flood. Another comparison is that which relates to the raw Thames water at Hampton, and the average filtered water delivered in London by the five Companies drawing from that river. A diagram is given which shows how great was the chemical improvement effected by these Companies even during the severe floods of June and November, though it also shows how much the impounded flood water affected the quality of the supply in February and December; making it, says Dr. Frankland, "of slightly worse quality, from a chemical point of view, than the raw river water passing three of the Companies' works at the time my samples of filtered water were drawn." The result was that some of the Companies possessing a small amount of storage capacity were actually enabled to deliver water in June and December of better quality than that supplied by the Chelsea Company, who, notwithstanding their much greater capacity for storage, had obviously been unable to entirely exclude flood water, and had, of course, been compelled to utilize it afterwards. But the disadvantage of "large, though insufficient, storage capacity" is said to have been more than compensated "by the very much higher organic purity of the Chelsea Company's water in November."

We have just quoted a somewhat puzzling passage, by which it is made to appear that some Companies with small storage capacity were better off for a time than another Company with a much larger capacity. The big storage reservoirs of the Chelsea Company seem to have operated to their disadvantage; so that they would have been better off had they been more dependent on the river. Big impounding reservoirs appear to be a mere trap, unless they can catch the water when it is good. To be sure of always doing so, they must be very large—holding more than a fortnight's supply. But this is only required on rare occasions; and the November flood is said to have been "exceptionally heavy." We should also imagine that it was exceptionally protracted. General Scott catalogues the Water Companies in respect to the number of the days' supply represented by the capacity of the reservoirs for unfiltered water; and he speaks of the large capacities as enabling the Companies to avoid the introduction of flood water to their filters. It is evident that the duration of the November flood was the cause of the disadvantage which befell the Chelsea Company. The East London Company have a storage capacity equal to fifteen days; but we are told that even this "was not sufficient to entirely circumvent the floods of January and November, though it effectually excluded that of June." To keep out the flood water is the great *desideratum;* and the impounding reservoirs of the Chelsea and East London Companies are obviously sufficient for this purpose, except when the duration of the flood is unusually prolonged. As a rule, big storage reservoirs are an advantage; and it would be strange if they were not, though Dr. Frankland's remarks would seem to imply that the largest which exist are not ample enough. A remarkable result appears in the case of the New River supply. This was kept free from flood water during the whole of the year; and the water was uniformly excellent in quality, while in most months it was "even better than the average of the deep-well waters." The impounding reservoirs of this Company are equal to less than five days' supply. But the Company have a large resource in well water; and the River Lea above their intake is less fouled by floods than it is lower down the valley.

Concerning the "raw material," Dr. Frankland is content to admit that "various contributions of organic matter of animal origin enter into the water both of the Thames and the Lea above the intakes." But, against this, we may set his further statement, by which he tells us "it is gratifying to find, as the result of recent researches, that the zymotic matters of a pathogenic kind are rapidly destroyed in running water, so that the most minute microscopic inspection of the water as it reaches the intakes of the various Companies has hitherto failed to discover in it a single pathogenic germ." Further, we are assured that it is now an established fact that efficient sand filtration would prevent the passage of such germs into the filtered water, even should they arrive in a living condition at the point where the water is abstracted for the purpose of the supply. "Thus," we are told, "the hygienic objection to

the use of filtered water taken from the Thames and Lea is removed." The conclusion is described as entirely supported by observations, carefully and laboriously conducted, not only in this country, but in Germany, and especially in the United States of America. The physiological test is also complied with, in the absence from London, since 1866, of zymotic disease traceable to the water supply. "Efficient" filtration is the point insisted on; and no doubt is entertained that want of attention to this requirement caused immense loss of life during the cholera epidemics of 1849, 1854, and 1866. Of the last named, we may say that the outbreak was due to an accident, and to the blunder of a subordinate. In previous years, the conditions were altogether different from those which now exist.

Notwithstanding what has been previously remarked as to the storage reservoirs of the Chelsea Company, the record of organic carbon and organic nitrogen indicates that, while both the Thames and the Lea were frequently much polluted with organic matter, the water actually delivered by the Chelsea and New River Companies "was never found to contain an excessive quantity." In the case of the remaining Companies, the proportion was only excessive in the month of November, during the unusually high flood which prevailed at that time. Another fact is that according to the proportion of nitrogen to carbon—the former being low—the organic matter present in the river waters as delivered in London "was to a very large extent of vegetable origin." The singular oversight is adverted to, whereby the Chemists who conducted analyses for the Companies committed an error which gave too large a proportion of nitrogen to carbon in the organic matters. There was also another complication which has attracted notice; the assistant who collected samples for the Companies' Chemists having inadvertently taken some of the New River Company's water believing it to be drawn from the Chelsea Company's main. It naturally came to pass, under these circumstances, that Dr. Frankland's analyses and those of the Chemists engaged by the Companies were at variance; and discredit was thus likely to be thrown upon the results. A conference having taken place on the subject, the mistakes were discovered and rectified; and the analyses have since been in agreement. It is now shown that the water derived chiefly from the Lea by the New River and East London Companies was almost invariably superior to that drawn from the Thames. It is explained that the floods of January and November are mainly responsible for the circumstance that the Thames water distributed last year was not equal in average quality to the supply given during the two previous years. Among the deep-well waters, that supplied by the Kent Company contained by far the smallest proportion of organic matter. Of the river water, that sent out by the New River Company stood much higher in this quality than any other. It equalled the East London Company's deep-well water, and even surpassed in a marked degree that of the Colne Valley Company. Of the Thames-derived waters, the supply by the Chelsea Company had the smallest proportion of organic matter. The amount of chlorine in the waters indicates that on no occasion during the year did brackish or tidal water gain access to the reservoirs. The waters drawn from the Thames and the Lea, as well as from the deep wells of the Kent Company, were all in a marked degree softer than in recent years. Only two samples of water derived from rivers, out of 84 examined last year, were found to be turbid, and these merely in a slight degree. On the other hand, seven samples of deep-well water were slightly turbid—a circumstance attributed to disturbance by the pumping machinery.

The section of the report devoted to bacterioscopic examination affords many interesting results. That the bacterial quality of water may differ in a considerable degree from its chemical quality, is generally understood. To how great an extent this may occur is shown by the circumstance that while the chemical composition of water pumped from the gravel near the banks of the Thames does not differ materially from that of the Thames water itself, and the gravel water is generally turbid, yet the raw water of the Thames contained during 1894 an average of 10,708 microbes per cubic centimetre, while the water abstracted from the natural gravel-beds by the Southwark and Vauxhall Company contained on an average only 157 microbes. The bacterial purity of the gravel water was such as not unfrequently to transcend that of the filtered Thames water sent into London. The Grand Junction Company have endeavoured to take advantage of this property by employing artificial gravel-beds. The experiment was commenced in 1893; but it is said not to have been entirely successful, though some good results have been obtained. It is rather startling to hear that there is a great bacterial inferiority in the Lea at the New River Company's intake above Hertford, as compared with its condition at the East London Company's intake at Angel Road; the latter being about 17 miles lower down the river. In September, the Lea at the New River intake contained the enormous number of 18,200 microbes per cubic centimetre; while at Angel Road it had on the same day, and in the same volume, only 2080 microbes. The result is described as extremely surprising; and the observations are too numerous to make it referable to accident. Dr. Frankland, therefore, desires to draw the attention of the Lea Conservancy Board to this unexpected condition of the higher portion of the river. It was, on every occasion, "enormously inferior bacterially to the Thames at Hampton." Dr. Frankland proceeds to show how the bacteria are reduced in number after the water has been abstracted from the Lea by the New River Company. It is mixed with purer water, and has the benefit of a flow of 25 miles down to Green Lanes through the New River Cut—the storage reservoirs still further reducing the microbes before the water enters the filter-beds. There is also striking evidence of the great bacterial amelioration which the Lea water, taken in at Angel Road, experiences by a storage of 15 days in the East London reservoirs. Similar results are observed elsewhere, as in the case of the Thames water taken by the Chelsea Company.

With respect to the conditions which influence the number of microbes in the Thames, results are given which demonstrate that this is determined mainly by the rate of flow of the river—in other words, by the rainfall—and but slightly, if at all, by either the presence or the absence of sunshine or a high or a low temperature. Sunshine is a powerful germicide; but the water through which it has to pass in order to reach the germs is a shield to the latter. There is an extended reference to the "very valuable experiments" on sand filtration instituted by the Massachusetts State Board of Health. Finally, we are told that the severe weather which has recently prevailed in England has brought to light some entirely novel phenomena affecting the filtration of water, which will require to be carefully studied, and which are engaging Dr. Frankland's earnest attention. Awaiting these results, it is satisfactory to learn that during the whole of last year the Chelsea Company never once infringed the standard of 100 microbes per cubic centimetre; the West Middlesex and Lambeth, only once each; the New River, twice; the Southwark, four times; the East London, six times; and the Grand Junction, eight times. There is also abundant reason to believe that none of the germs were hurtful.

Midland Association of Gas Managers.—The spring general meeting of this Association will be held next Thursday, at the Gas Offices, Coventry (by permission of the Gas Committee of the Corporation), under the presidency of Mr. G. Winstanley, the Engineer and Manager of the gas-works. According to the circular issued by the Honorary Secretary (Mr. C. Meiklejohn, of Rugby) the business will be only formal. After it has been disposed of, the President will offer the members light refreshment, and then conduct them over the gas-works. They will afterwards drive through Stoneleigh Deer Park to Kenilworth, and visit the historic castle. Tea will be provided by the President at the King's Arms Hotel; and the return drive to Coventry will be by a different route.

The Sale of the Soho Works, Birmingham.—Last Tuesday, the Soho Works, at Smethwick, Birmingham, which have been established about 120 years, and been so intimately associated with the names of Boulton, Watt, and Murdoch, were offered for sale by public auction, in accordance with the intimation already given in our columns, by Mr. F. J. Horsey (Messrs. Fuller, Horsey, Sons, and Cassell). The highest bid for the works as a going concern was £19,900; but the Auctioneer would not let them go at this price. He then offered the freehold buildings and land, without the machinery; but he could not obtain a bid. Subsequently some miscellaneous lots of machinery were disposed of; and it was announced that, if certain negotiations which were in progress for the disposal of the concern as a whole were not completed, the sale would be continued on the following day. However, the transfer was effected in the evening to an important Company; and the works will be continued and the contracts finished.

The Alleged Noxiousness of the Welsbach Light.—On the occasion of the recent acquisition of the electricity works at Cheltenham by the Corporation, Mr. W. H. Preece is reported to have spoken in disparagement of the Welsbach incandescent gas-light, which he asserted was "injurious to health." According to a local paper, he went on to say that when people found this out, and wanted a good as well as a clean and wholesome light, they would not go back to the ordinary gas-burner, but would go to the Cheltenham Corporation to get it. This statement, coming from a responsible Government official, naturally roused the General Manager of the Incandescent Gas-Light Company, Limited (Mr. Julius Moeller), who promptly refuted, in a letter to the above-named paper, the assertion as to the injuriousness of the Welsbach light. He quoted, in his support, the report of Professor Renk, the Director of the Hygienic Institute of the University of Halle, to the effect that if there is any carbonic oxide present in the products of combustion of the Welsbach burner, it is in far too small a quantity to be injurious to health; and he backed this up by the published opinions of Professor Carlton Lambert, M.A., F.R.A.S., of the Royal Naval College, Greenwich, and of the *Lancet* Commission. In face of reports from such authorities, Mr. Moeller cannot conceive on what grounds Mr. Preece stigmatized the Welsbach light as "injurious to health." He can easily understand that it is injurious to the health of the electric lighting industry; and he supposes it was a certain feeling of annoyance, caused by the appreciation of this fact, which led Mr. Preece to make the statement he complains of. We agree with him that when responsible officials descend to misrepresentation as to rival concerns, the limit of one's patience is reached.

NOTES.

The Action of Oxide Paint upon Iron.

Mr. E. Gerber has submitted a paper to the American Society of Civil Engineers upon the result of an examination carried out by him into the condition of certain bridges and other iron structures which had been painted with iron oxide paints. This examination was suggested by fears lest paints of this nature were rusting the metal to which they were applied, from the fact that in some structures rust was found under the paint, while there was no indication of it on the surface. A large number of iron structures were inspected, and in every example rust was found to some extent under the paint, irrespective of the nature of the latter. The rust occurred in limited spots—the greater part of the work being clean. The age of structures apparently had nothing to do with their rusting. It was noticed that iron that had been oiled in the shops was much cleaner than that which had received a coat of paint in the same stage of preparation. Heavy rusting under the paint was rare: the generality of the rust-spots being of a thin, filmy character, and a yellowish colour, and apparently not in an active state. Where the paint was pure oxide mixed with pure oil, it was found to be tough and adherent to the metal; the toughness and adhesion improving with the age, except in one instance where it had been laid on too thickly, and had never hardened. Red lead had gone brittle, and was easily removed. From Mr. Gerber's observations, he concluded that the oxide of iron applied as a paint is not the cause of rusting of iron structures, which was the principal thing to be determined. He ascribes the rusting observed to want of proper cleaning of the metal in the shops; and he declares that, to obtain good results from painting, absolute cleanness of metal is the first requisite. This should be accomplished in the shops by some mechanical or chemical means. The first coat after cleaning should be oil, which permits of the state of the surface being seen.

The Effect of Cold upon Iron and Steel.

It is remarked in *Engineering* that the pioneers of mechanical engineering—men who knew nothing about tensile strains and their tests—did not doubt that iron and steel were less reliable in winter than in summer. As is frequently the case, however, the earliest investigations directed to ascertain the truth of the matter did not confirm the practical men's opinion. It has consequently followed that while, for a generation or two, students of engineering have been taught by their text-books that iron or steel are as strong when the temperature is below the freezing-point as when it is above it, practical hoisters and erectors of ironwork are still averse to trusting much to their metallic gear during severe weather. A very extensive series of experiments, in which a large number of full-sized steel railway axles were submitted to impact tests at different temperatures, has been carred out by Mr. Thomas Andrews, of the Wortley Iron-Works, Sheffield. It was a convenient way of ascertaining the effect of variations of temperature upon the steel subjected to a jarring strain; and the results are applicable to all forms into which the same class of material may be made up. They go to show that there is, in fact, a decided loss of ductility and of capacity for enduring punishment at the lower temperatures. The fracture in the cold breaking tests was also more crystalline than in the warmer ones. It therefore follows that the view of the practical men is justified, and that iron and steel are really to be regarded as more brittle in winter than in summer.

An Improved Coal-Waggon.

The Corporation of Birmingham are adopting a new class of waggon for the conveyance of coal to their Windsor Street Gas-Works. It has been specially designed for the purpose by Mr. Charles Hunt and Mr. A. L. Shackleford, M.Inst.M.E. The waggon is of the hopper type; and from it the coal, on its arrival at the works, is dropped to the foot of the elevator which supplies the retort-charging machines. It is thus actually conveyed and used without assistance from first to last of any manual labour; a considerable saving being thereby effected. As there are many features connected with this waggon which are worthy of attention, the following short description of it may be of interest to our readers: The waggons, which are made entirely of steel, are 16 ft. 3 in. long and 8 feet wide at the top; and they are constructed to carry a full 10-ton load of coal. The bottom doors are formed of steel plates ½-inch thick arranged to slide on rollers, and actuated from both sides of the waggon by means of winch handles connected with shafts which are geared into racks and pinions. The doors are thus opened and closed with the utmost expedition and ease—forming a striking contrast to the ordinary system of bottom doors, and obviating the necessity of men getting underneath to close them. The entire operation of clearing a waggon of its contents, and despatching it again to the colliery, only occupies a very few minutes. The under-frames consist of channels, angle-bars, and plates of steel; and the waggons are built in all respects in accordance with the rules and regulations for freighters' waggons running on the main lines of railway. At the present time, fifty of these waggons are being built at the works of Messrs. Brown, Marshalls, and Company, Limited, Britannia Railway Carriage and Waggon Works, Birmingham; and, from the experience already obtained in testing two of the waggons, it is expected that a large saving will be effected in the cost of conveying coals into the retorts.

The Heat of Incandescent Electric Lamps.

Dealing with the heat yielded by incandescent electric lamps, it is reported that Captain Exler, of the Austrian Army, has found that a 16-candle power lamp bulb may attain a temperature of 94° C., and a lamp of 25-candle power a temperature of 101° C. Two lamps placed inside a hole in a piece of wood developed a temperature of 215° C., which decomposed gunpowder and other explosives, but without detonating them. The same cavity was then filled with water, which was made to boil in 15 minutes. Mr. C. C. Haskins, writing upon this text in the *Western Electrician*, lays stress upon the necessity of care in handling incandescent electric lamps, providing them with screens, or even (as is sometimes seen in drapers' shops) draping them with light, combustible materials. He remarks with truth that the cumulative effect of heat is little understood by the majority of people, who can hardly be brought to believe, notwithstanding daily proof, that a steam-pipe can cause a fire. They do not perceive, what is nevertheless true, that in such cases it is not wood that the steady heat of the pipe sets on fire, but partly carbonized woody matter, which, after arriving at this condition as the result of a long process of daily heating, does not require so high a temperature to ignite it as it did when green. What is true of wood is true of paper (most of which is really wood) when employed for lamp-shades. An incandescent electric lamp closely wrapped up in paper will set the paper on fire sooner or later. The many articles made of cellulose preparations are capable of being explosively ignited by the same agency.

TECHNICAL RECORD.

THE INCORPORATED GAS INSTITUTE.

The Programme of the Forthcoming Annual Meeting.

As our readers are aware, the annual meeting of The Gas Institute will take place in Edinburgh on the 11th, 12th, and 13th prox., under the presidency of Mr. R. MITCHELL, Engineer of the Edinburgh Works of the Edinburgh and Leith Gas Commission. The official programme having been issued, we are able to give an indication of the nature of the proceedings.

On the first day, an official welcome will be offered to the Institute by the Right Hon. the Lord Provost of Edinburgh, accompanied by the Conveners and members of the Gas Commission. The preliminary business will then be disposed of, and the report of the Council, accompanied by the accounts, presented. The report opens with the gratifying statement that the roll of membership has been increased by 30 in all the classes; bringing the total up to 583. The balloting-list for the next election will, if approved, make the number more than 600. The Council congratulate the members on so satisfactory a result; and they express their full confidence that the Institute will continue to grow in importance, as it has hitherto done. Nine members have been removed by death—viz., Mr. F. J. Baynes, Ystrad; Mr. G. Garnett, Ryde; Mr. T. Giles, Bridport; Mr. T. Hardick, Salisbury; Mr. J. Hirsch, Liverpool; Mr. J. Lupton, Leeds; Mr. W. Miles, Clitheroe; Mr. F. Weller, Yarmouth; and Mr. J. W. Whitaker, Wakefield. The decease of Mr. Garnett, whose great services to the Institute are specially alluded to, created a vacancy for a Trustee; and the Council have appointed Mr. John West to fill the office. The financial condition of the Institute is regarded as satisfactory. The Council express their regret that, owing to illness and increasing infirmity, Mr. W. Livesey has had to resign the position of Parliamentary Agent to the Institute; and they announce that arrangements have been made with Messrs. Rees and Frere to continue the work. They also record the resignation of the Honorary Secretary, Mr. J. Hepworth, owing to his relinquishment of his position as Gas and Water Engineer to the Carlisle Corporation. In accepting the resignation, the Council unanimously resolved to place on the minutes their sincere appreciation of the manner in which Mr. Hepworth had carried out his duties during his term of office, and their deep regret that he felt it incumbent upon him to relinquish an appointment he had so honourably filled. They feel confident that with this expression the whole body of members will unanimously agree. To fill the vacancy thus caused, the Council have nominated Mr. A. Dougall, Engineer and Manager of the Tunbridge Wells Gas-Works. The presentation of the report and accounts and the premiums for papers will be followed by the President's address; and the rest of the day will be occupied with papers. The annual meeting of the donors and subscribers to the Benevolent Fund will be held in the afternoon. In the evening, there is to be a reception by the Gas Commissioners, followed by a *conversazione*, concert, and dance.

On the second day, Professor Lewes will open the proceedings with a lecture on "Acetylene, and the Part it Plays in the Luminosity of Flame;" and the reading and discussion of papers will be continued. In the afternoon, the members will

visit the Forth Bridge; and in the evening there will be a smoking concert.

On the third day, the remainder of the papers will be taken, and the rest of the general business disposed of; and on the following day, there will be an excursion to the Firth of Clyde and Loch Lomond.

The following is the list of papers to come before the meeting for discussion: "Gas as a Motive Power in Generating Electrical Energy for Private and Public Lighting," by F. H. Medhurst, of London; "The Practice of Districting, with a View to the Equalization of Pressure," by F. W. Cross, of Wellington, Salop; "The Management of, and Remuneration to, Gas Workers," by J. M'Crae, of Dundee; "The Transfer of Gas and Water Works Undertakings to Public Authorities," by W. Newbigging, of Manchester; "Illumination" (with illustrative experiments), by Professor Ivison Macadam, of Edinburgh; "Photometry as Applied to the Verification of the Illuminating Power of Gas Supplied to Towns," by W. Sugg, of London; "Some Improvements in the Methods of Manufacturing Sulphate of Ammonia," by C. Stafford Ellery, of Bath; "Unaccounted-for Gas," by D. Irving, of Bristol; "Combustion of Coal Gas for Fuel Purposes," by Professor Vivian B. Lewes, of Greenwich; "Washing," by Lewis T. Wright, of London.

THE SOUTHERN DISTRICT EXCURSION TO SOUTHAMPTON.

The excursion of the Southern District Association of Gas Engineers and Managers to Southampton last Thursday was favoured with splendid weather, and was extremely successful and enjoyable in every way. As arranged by the Honorary Secretary (Mr. J. W. Helps, of Croydon), the members met at Waterloo, and proceeded to Southampton by the 11.15 train. On arriving at Northam Station, the party were met by the President (Mr. S. W. Durkin), who had brakes in readiness to convey the visitors to the works of the Southampton Gas Company, where in the first place full justice was done to the excellent luncheon provided by the hospitality of the Directors of the Company, several of whom—including the Chairman, Mr. R. C. Hankinson—were present to formally welcome the Association to the town. Fitting acknowledgment of the kindness of the Directors and their Manager, the President, was made on behalf of the Association by Mr. C. C. Carpenter. But, by a merciful dispensation, there were no speeches; and the private business of the Association, which it was necessary to transact at the meeting, was limited to the election of two new members—Mr. Philip P. Channon, of the gas-works, Hayward's Heath, and Mr. James F. Watson, Manager of the North Camp and Farnborough District Gas Company. After luncheon, an hour was spent in inspecting Mr. Durkin's works, which were, of course, in perfect order, and expressed in every detail the most careful design and consummate administration. A move was then made in the conveyances to the docks, where, by the kindness of Mr. John Dixon, the Marine Superintendent of the London and South-Western Railway Company, who was present in person, a tug was in waiting to take the party round the seaward face of the great dock extension works which are making of Southampton one of the first ports in the world for accommodating the highest-class modern ocean transport service. On landing, an opportunity was afforded of inspecting the great graving dock in course of construction, and nearly finished, which will in a short time be one of the principal glories of the port. It was easy to realize that there is no such dry dock accommodation at present existing in the world as this magnificent work will provide. Southampton and the country are to be congratulated upon the progress of the enterprise that has already done so much to improve and develop the natural and other advantages of the chief southern port of the kingdom. Tea was provided at the South-Western Hotel before the return journey, which was duly made, according to the programme, at half-past seven. The President and Honorary Secretary are to be complimented on the perfectly satisfactory result of their efforts to make the day an example to the members of the benefits that accrue from joining the Southern District Association.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Except for one short but heavy shower of rain late in the afternoon, the weather was exceptionally favourable for the annual excursion meeting, on Saturday last, of the Manchester District Institution of Gas Engineers. The programme arranged for this—the one hundred and second quarterly—meeting was for a trip by the new Dore and Chinley Railway to Castleton, Derbyshire, and thence a drive to Hathersage, *viâ* Hope and Bamford. Immediately on arrival at the Peak Hotel, Castleton, luncheon was served; and, before separating, an opportunity was found for confirming the minutes of the previous meeting. These were read by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), and approved, on the motion of the President, Mr. George Smedley, of Buxton. In doing so, Mr. Smedley thanked the members for the kindly allusions made to him at the February meeting, when (consequent on his indisposition) he was unable to be present, and the duties of the day had to be performed by the Senior Vice-President, Mr. Isaac Carr, of Widnes. Mr. Smedley trusted his health would permit of his carrying out the remaining duties of his year of office to his own satisfaction, as well as to that of the members generally. Letters to Mr. Mellor from members unable to be present, were noted as follows: Mr. C. A. Craven, of Dewsbury; Mr. R. Hunter, of Chester; Mr. S. Crossland, of Holmfirth; Mr. J. Martin, of Ormskirk; Mr. G. W. Lupton, of Otley; Mr. J. E. Lamb, of Altrincham; Mr. J. H. Whittell, of Hawoth; Mr. J. R. Smith, of Padiham; Mr. J. W. Buckley, of Formby; Mr. G. R. Pickering, of Cheadle; Mr. R. G. Shadbolt, of Oakenshaw; Mr. James Parkinson, of Brighouse; Mr. A. E. Loam, of Stalybridge; Mr. W. R. Herring, of Huddersfield; Mr. J. Chew, of Blackpool; Mr. J. Mackenzie, of Wilmslow; Mr. F. Sidwell, of Winsford; Mr. J. C. Ingham, of Ramsbottom; Mr. W. Duff, of Morecambe; and Mr. S. Glover, of St. Helens. On the return of the party from Hathersage, tea was served at the Peak Hotel; and the journey to Manchester was made by the train due in at the Central Station at 8.18 p.m. Mr. Mellor's arrangements for the comfort and enjoyment of the members and their friends were much appreciated; and the various items on the programme were gone through with commendable punctuality.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Half-Yearly Meeting at Sudbury.

We complete to-day our report of the proceedings at the above meeting, by giving the paper read by Mr. A. DRAGE, of East Dereham, and the discussion thereon.

GAS-WORKS CONSTRUCTION.

In these times, it seems almost an impossibility to find a subject upon which to write a paper in relation to gas manufacture, or the machinery used in that manufacture, as every item appears to have been threshed out, leaving nothing but husks. Small works are rather handicapped by not having the improvements common to large works; and the managers of the former cannot devote their time to details as their brethren in the latter can. But, having been asked by our Secretary to contribute a paper, and having at the meetings of this Association expressed my ideas on several subjects, I made up my mind to give a paper under the above title. A new works was built at East Dereham some six years ago; and a few hints to those who may happen to have a like responsibility placed upon them will not be useless. In entitling my paper "Gas-Works Construction," it is not my intention to supply quantities, prices, &c., but merely to give some hints as to the buildings, machinery, and apparatus required, and where they can be placed to the best advantage.

The first consideration is the site of the works. This should be at the lowest point of the town, without being in a marshy or swampy place. It should be as dry as possible, with consistent good foundations. Some erectors say the lowest point does not signify; but opinions will differ. To have them at the lower level must be an advantage in these days of steam-rollers and sewage-works, when the pipes are not well packed and breakages occur. If mains and services are sound (which is expected when first laid) "all's well." But time tells us that we must be prepared for breakages; and it is well to take precautions. The site should be as near to railway accommodation as possible, so as to secure a siding into the works, which not only reduces the cartage bill, but also avoids the waste of coal which takes place in loading and unloading, and in transit.

The retort-house should be of a size adequate for the number of retorts required at the heaviest make of the year, with a reserve bench; and wide enough for the men to work comfortably. It is often the case that economy is exercised here, which means an injury to the health and to the working powers of the men. The retort-house should be well ventilated, without through currents playing direct on to the workers.

The coal-store should be contiguous to the retort-house, and both floors on the same level (excepting in the case of stage houses). Sinking a coal-store 2 and 3 feet below the retort-house, as is common in some districts, is more expensive than raising the roof 2 or 3 feet higher, or adding 2 or 3 feet to the length. The store should be capable of holding at least four months' supply.

The engine and exhauster house should be placed as near to the retort-house as possible; but on no account should there be direct communication between the two, as the smoke and dust issuing from the retort-house during the period of drawing and charging will be hurtful to the machinery in the exhauster-house; and these substances will penetrate through either door or window crevice. If an engine is under the charge of the stoker, a gauge fixed in the retort-house, and worked from the exhauster-gauge, will obviate direct communication. In these days of automatic valves and governors, it is an easy matter, in small works of from 8 to 16 million cubic feet per annum, for a stoker to attend to the exhauster with his other duties.

Purifiers and purifying material should be under cover; and the house should be well ventilated. But at the same time, a cold cutting wind should not play direct on to the purifiers, or cracked cups in the winter will result. Floors for oxide should be open on at least one side and at one end.

In the meter-house, accommodation for a heating apparatus, or a system of heating, would be advantageous. Users of steam, who have their boilers situated near the meter-house, can no doubt devise an apparatus of this description to keep up the temperature to (say) 50°.

Stores and other buildings are very necessary, and can be placed on the space of the site unoccupied, for convenience and purpose required.

A manager's house is a requisite. In medium-sized works, where two or three men are employed, it is handy to have the manager living on the works, though, at the same time, it necessitates him being in constant attendance, as the men, knowing of his proximity, do not exercise their judgment as they could do if they tried. Still, it is very desirable to have someone in attendance to take responsibility; and therefore managers of small works must grin and bear it.

Turning now to the plant. Carbonization is the first process; and therefore retorts and settings are first on the list. It will be a grand time when managers can all agree on a standard size of retorts, and also on a standard shape. But this must be left for future development. For medium-sized works, six retorts in a setting is sufficient; seven retorts in a setting means a centre one with the fire playing directly upon it—resulting in shorter life to that one, although, no doubt, a greater heat. Generator and regenerative furnaces are well to the front; and as each inventor claims for his invention superiority above others, it is well to study the cost and durability, and the suitability of each to the locality. For small works, a distinct advantage would be gained by their adoption, as they can be left for six hours without deteriorating the heat. Our Scotch brethren have taught us their use, as the papers read at their Association meetings eight or nine years ago show. As water or steam plays a part in these furnaces, some will ask, How can we get steam when we do not use a boiler? Water can always be forced upwards by a pump into a cistern; and gravitation will do the rest for you. The want of steam need not deter you from using the furnaces, for as many work with water as with steam. Of course, the consideration of water lying shallow beneath your site will prevent you sinking down.

Ascension-pipes should be 6 inches in diameter, and carried at least 4 ft. 6 in. above the bench (that is, including the H-pipe), to allow the hydraulic to stand at least a foot from the retort-bench. A space of 6 inches between the pipe and the front wall will be found a good cure for the manager's annoyance of stopped ascension-pipes.

Anti-dips, if not too complicated, are advantageous, because with them carbon deposit is not so great as with dips. Retorts with anti-dips will work four to six months without scurfing; those with dips require cleaning every eight to ten weeks.

Hydraulic mains should be provided with means for flushing out with ammoniacal liquor at least once a week. It is preferable to have a section for each setting of retorts. This may seem expensive. But the utility will be found in working; and it will pay its cost before many working seasons have passed.

Foul mains carried round the retort-house act as a condenser, and lightens the work of the condensers proper. As it is always advantageous to take the tar out at the highest temperature possible, a tar-extractor will be found useful at the point of exit from the hydraulic main, or as near to it as possible. In many works the tar-main is far too small for the duty it has to perform, and stoppages in it are often a trouble to the manager. In this part of the plant, it is always best to err on the far side of economy.

Condensers are often in the opposite direction—made for four times the work required of them, and also placed in the coldest position in the site (which is quite right). In being so large, their tendency to stoppage is a source of anxiety, especially in winter, when every charge is precious and a stoppage means loss. If the condensers are large and exposed, it would be advisable to have valves by means of which one-half could be worked while the other half is being cleaned or unstopped; and, if required, all can be worked at one time.

Engines, both steam and gas, are now used for exhausters. Gas-engines are doing their work cheaply and well; but as steam is an essential article on the works, it would be more economical to use it. Steam is useful in clearing condensers, tar-mains, and various other parts of the plant.

Exhausters of three patents seem to be most in use at this time—viz., the rotary, the reciprocating, and the steam-jet. The rotary is by far the cleanest working; has no pistons passing in and out as in the reciprocating; the tar is not drawn into the packing, causing it to rot, which means leaky glands; and, of course, are screwed up to their utmost, and wear away the piston-rod much quicker than in the rotary.

Washers seem to have reached the acme of perfection, and do their work well. Each manager has his hobby in these, and each maker claims special advantages for his apparatus. Therefore it would be unfair to recommend any one. Each individual must use his judgment in fitting his convenience.

Scrubbers are improved upon greatly; and the old broom scrubber seems to be rare. The coke scrubbers are also disappearing; the coke which has been used in them being a drug in the market, as it could only be burned in places isolated from dwellings, or by those having a very high shaft. Wood or screens have replaced coke, and for economy will be hard to beat. Boards costing £2 10s. or £3 per annum cannot be considered extravagant for this mode of purification. Washer-scrubbers are a valuable apparatus, ensuring a constant supply of liquor to the washer for washing purposes, after doing part of its work elsewhere.

Purifiers should allow a large area for the gas to play over with a medium thickness of material for purification. Where works are situated in a town, or are surrounded with dwellings, to treat the gas through oxide first and lime afterwards will be found advisable; as it will lessen the smell of that much-abused product, "blue billy." Some of you think lime the best, purifying material, as it takes from the gas all objectionable matter. We know oxide will not do this; but, by using lime afterwards, that objection to oxide is removed. A purification account decreasing from £50 per annum to £15 in a works making 10 million cubic feet per annum, should be a great advocate for this mode of purification.

The station meter, in all cases, should be purchased of a capacity sufficient to allow for an increase, and thus permit of the cost being spread over a number of years. By this means the meter will not be strained or damaged, and the registering will be more correct.

It is always best to have two gasholders. They must be of capacity sufficient to allow a two days' storage at the heaviest consumption. When an error is made in this connection, it often becomes apparent in the fuel account. A difference in storage conditions will go a long way to account for a difference in fuel account.

I omitted from my buildings a house for the governor. As it is common to put it in the meter-house, it was not necessary to have a separate building. As the meter-house is advised to be heated, that is the best place to put the governor to keep it in working order. Improvements in governors are occurring almost yearly. Cowan's, with all its modern improvements, seems to be perfection. It is well to err on the large size with this instrument, as if it is small, it will cause a series of complaints from consumers. It is convenient to place the gasholder valves in the meter-house, as there they will be constantly under the foreman's eye when registering the meter.

Valves are the most important articles throughout the works, although the least. There are four-way valves, dry and wet centre-valves, and Weck's valves, which are well spoken of, and are now coming into use. The old rack-valves are still found useful, and hold their own with the improved. A good substitute for common valves, and one that serves two purposes, will be found in Lyon's syphons. The advantage to be gained by the use of these is that no sticking or jamming takes place, and no faces wear away. Sufficient water to fill above the partition is required; and it can be pumped out afterwards. They are also valuable at street junctions, for isolation of streets, or for testing purposes.

Tar and liquor storage should be of as large capacity as can possibly be obtained, consistent with one's funds; and a good separator will be found advantageous.

I have touched, more or less, on all (or nearly all) the buildings and apparatus required for gas manufacture; and if a discussion is provoked, and ideas are put before you for future papers, I shall be satisfied. A few hints are useful. Thoughts inside are useless to other people while there; but if expressed audibly will give information to those who are bashful in asking, and bring out those ideas that seem far away.

Discussion.

Mr. J. CARTER (Lincoln), referring to the paragraph in the paper on the retort-house, said the author stated that it should be of a size adequate for the number of retorts required at the heaviest make of the year. With this, they were all in perfect agreement. But he went on to say "with a reserve bench." It would have added to their information if Mr. Drage had mentioned what he considered, having due regard to the necessities of a winter day's supply, to be a fair workable reserve power to have in the retort-house. On the same question, he pointed out, with regard to settings of sevens, that the centre retort, being subject to greater heat, was worn out much quicker than the other six; but still he (Mr. Carter) thought that it would not do to put aside all ideas of adopting generator or regenerative furnaces on that account. His own experience, and that of one or two of his friends in charge of small works, was that generator furnaces could be adapted to settings of sevens; and that the centre retort (which was immediately over the crown of the furnace, and did not come into contact with the fuel as it used to do) lasted—if not exactly quite as long, yet there was not so much difference in its life as to call for special reference. Even in small works, the adoption of the more modern erections would enable the managers to use settings of seven, eight, or nine retorts, if the necessities demanded it, without subjecting them to the loss that had occurred through the speedy destruction of the centre retort. He did not think Mr. Drage had allowed sufficient margin in the distance of his hydraulic main from the retort-bench. The difficulty of stopped pipes would, he (Mr. Carter) fancied, remain with them if their hydraulic mains were not elevated more than a foot above the bench. With regard to the free use of oxide of iron for purification, there was no doubt it was a much cheaper material to employ than lime, though he was not sure that spent oxide was the commercial material that it was a few years ago, nor that the economy was so pronounced as it was then. If oxide of iron

was freely used, of course it would perform all that was required of it in the way of eliminating the sulphuretted hydrogen; but what he would venture to point out was this, that, unless lime was also freely used, they could not deliver the gas to the consumers so free from carbon sulphide as it should be. His own opinion was, all points considered, that the use of oxide of iron might be the cheaper in the long run; but the free use of lime would be best both for the gas manufacturer and the consumer.

Mr. J. T. JOLLIFFE (Ipswich) said the author seemed to have sketched an ideal gas-works; and if they were starting *de novo*, they would do so somewhat on the lines laid down. He should take exception to the site of the works being at the lowest level. There was one strong objection to this—the liability to floods; and in this liability there was great danger of the town being put in darkness. He could not himself see any reason why a gas-works should not be placed—not at the top of a hill, but at some happy medium between the two. With regard to the retort-house, of course it should be fully adequate to its work; and personally he should be glad if some system of standardizing the size of the retorts could be determined upon. The haphazard way in which they chose the size of retorts was very detrimental to their working; and a great deal of their trouble —especially that of stopped ascension-pipes—was due to the wrong proportion of the retorts. He thought the depth was far greater than it should be in relation to the width. He could not at all agree with the author as to the ascension-pipes being placed only 6 inches from the setting. His ascension-pipes were twice that distance; and he had been troubled very seriously with stopped pipes. He was looking to the retorts being made shallower. The common proportion of the retorts now used with West's apparatus was 21 in. by 15 in; but if it was 21 in. by 12 in., and the area above the charge lessened, the superheating of the gas (if he might so term it) would be considerably reduced, and trouble from stopped pipes thereby much diminished. He was quite in accord with Mr. Carter with regard to purification, and did not think the best and cheapest purification was done by oxide. The objectionable presence of carbonic acid in the gas was too commonly left out of account. By allowing it to remain in the gas, there was a diminution in the illuminating power; and therefore true economy resulted from the combination of oxide and lime. He would go a point farther, and say that it was their duty to eliminate the whole of the sulphur compounds if possible; and he was firmly of opinion that they should supply to the consumers the purest gas they could.

Mr. W. J. CARPENTER (Yarmouth) said he could not follow Mr. Jolliffe's remarks as to the depth of retorts, and the distance between the top of the retort and the charge. If they did not want stopped pipes, they must keep the retorts full, and the space between the top of the charge and the retort at a minimum. A light charge with a big space led to difficulty, of which he believed Mr. Jolliffe had had a large share.

Mr. A. MITCHELL (Bury St. Edmunds) differed from Mr. Carpenter and Mr. Jolliffe in their opinion that a large amount of space between the coal and the top of the retort was the cause of ascension-pipe stoppages; and he said he could honestly assert that he never knew of such a case. Stoppages were produced by a great number of circumstances, which might all be present in one works, and only a few in another. For many years, in the works with which he was connected now and previously, the space between the coal and the top of the retort was greater than that to which Mr. Jolliffe had referred, and stopped pipes were almost unknown. They depended largely upon the quality of the coal carbonized. With regard to purification, he must say that for many works oxide was amply sufficient. There were gas-works under the sulphur clauses and the jurisdiction of an inspector, which necessitated the sulphur compounds being reduced to a minimum. This caused great expense, and gave the public no adequate recompense for the large outlay incurred. If the works were situated near to a source of supply of good lime, it might be better that this material should be used for purification, taking all things together, than that oxide should be depended upon entirely; but where lime was very expensive, with ample scrubbing power, oxide would be sufficient for purification. Mr. Drage suggested the use of lime and oxide, and that the oxide should be used first and the lime afterwards. In his past experience with lime and oxide, he found it was preferable to use a layer of lime in the bottom and a layer of oxide on the top in each purifier of a series; and the gas was passed through the lime first. Better results were obtained all round by working on this system than by purifying first with oxide, and then with lime, as Mr. Drage proposed. He had every sympathy with the suggestion that the purifying materials should be under cover; and no doubt they had all wished in the past winter that their purifiers had been in comfortable houses. With good houses for the purifiers and material, in severe weather they could warm them up to 40° or 50°, and the purification could be carried on without any difficulty; and, if it was necessary to change the material during a frost, this could be done without having to apply steam before the lids could be removed from the purifiers. In his opinion, the greater part of the apparatus on a gas-works should, if possible, be under cover, and not be subjected to such extremes of temperature as they were in this country. Of course, they could not cover the gasholders. But still steam could be applied to them; and, as far as possible, all the apparatus used in the manufacture of gas should be kept at an equable temperature—at least, some degrees above freezing-point.

Mr. J. H. TROUGHTON (Newmarket) agreed with Mr. Drage that anti-dips would be advantageous if they could only get one that was not complicated. He had tried anti-dips, but had had to discard them. If they could get an anti-dip simply constructed, it would diminish back-pressure on the retorts, minimize scurfing, and possibly reduce stopped ascension-pipes—at all events, a little. During the very severe weather this year, he was troubled very much with stopped ascension-pipes; but last year he was not. He was working under precisely the same conditions this year, with the exception of the heats, which were a little higher; but he was using exactly the same retorts, beds, and coal. Consequently, he attributed the trouble to the high heats. He also thought that 6 inches was scarcely sufficient space for the ascension-pipes to be from the front of the bed; and, as Mr. Jolliffe suggested, 12 inches would most certainly reduce stopped pipes, and the lifting of the hydraulic main a little higher from the bed would tend in the same direction.

Mr. E. J. BROCKWAY (Cleethorpes) did not see very much room in the paper for criticism or discussion; and it seemed to him it might be called an elementary sketch of gas plant generally. With reference to the site of the works, he asked Mr. Drage what they were to understand by the statement that placing the works at the lowest possible level, must be an advantage in these days of sewage-works and steam-rollers? As to the number of retorts in a setting, in his experience, seven or eight were not too large a number for even a medium-sized works, especially when the length of the retort-house was limited, as it was in the works of which he had charge; and, in the near future, he intended to construct some settings of eights. Neither did it follow that the centre seventh retort should be acted upon by direct heat from the furnace; it could be arranged so that it was shielded. If his ascensions and hydraulic main were fixed the short distance from the retort-bench given by Mr. Drage, he should expect to have stoppages. His experience agreed with one or two previous speakers, that light charges were often the cause of pipes being blocked; and that the smallest possible area between the coal and the top of the retort was the best means of preventing them. He had never used anti-dips; but he found that the period within which retorts required scurfing depended upon the seal, and whether the exhauster gave a fair, even gauge. With a light seal—say, ½ or ¾ inch—and working with a level gauge, he found that his retorts would go on for at least three months without requiring scurfing. But if they had a 2 or 2½ inch seal, and the exhauster-gauge jumped up and down—say, an inch play up and down—scurf would be formed in the retorts in a little time. Regarding the statement in the paper that the rotary exhauster was preferable to the pump exhauster, he had worked both; and he found that the piston-rod of the pump exhauster was quite equal in action and in wear and tear to the rotary. As to the purifying account, he asked what Mr. Drage meant by a decrease from £50 to £15—whether it included labour, or was merely the cost of the material? He believed in using both oxide and lime; and in working the lime first and the oxide last. Mr. Drage also said a good substitute for common valves would be found in Lyon's syphons. He (Mr. Brockway) would be very sorry to use these syphons in place of any common valves; and he should think they were a poor makeshift. They might be used in the town for testing mains and so on; but he should object to their use about a gas-works.

Mr. R. BRIDGE (Doncaster) remarked that something had been said as to the over-heating of the seventh retort in a setting of seven. Under the old system of heating retorts, it was the case that the centre one over the fire was the first to go, and perhaps before the other six had been half used up. But under the generative system in which the fire was fairly distributed through the setting, no such thing occurred. He happened to put up two settings of generators in November, 1893; and they were in constant work up to the end of March, 1895, when they were put out simply because they had no need of them. The furnaces and retorts were then overhauled; and he found the centre retort as good as the outside ones. These were settings of sevens. The furnaces were cleaned out, and not a brick was removed after their sixteen months' constant firing. Therefore, under the generator system they need not be afraid of burning out the retorts—whether central or in any other position. He did not agree that the hydraulic main should only be a foot above the retort-bench. In his experience, that was not half enough. The stoppage of the ascension-pipes did not depend upon the distance they were from the front of the bench. His were about 6 inches; but if they were 6 feet, it would be the same. It depended more upon the charging and the heat of the retorts, and, of course, in a certain measure, on the quality of the coal. If the retorts were fully charged —that was, with sufficient coal to be carbonized reasonably up to the time of its withdrawal, stoppage of ascension-pipes would not be the bugbear that it had been. With the settings he had referred to, he had not had a stopped pipe through their working of sixteen months. The dip he had was the ordinary seal, with the tar taken away from the bottom of the hydraulic main; the water was run off at the top; and the gas was taken from another source altogether. He had never had a

stopped hydraulic main. The gas was carried from each side of the mouthpiece to the hydraulic main, and from there across the house to the raw main. Although the main from the hydraulic to the raw main was 20 feet long, he had never had a stoppage in it. Mr. Drage made a remark about all apparatus being under cover. All his (Mr. Bridge's) apparatus was covered. He also carried the exhaust-pipes from his engines all round the purifier-house and shops—something like 300 feet in length—and, although one side of his purifying-house had been open the whole of the winter, he had not had a frozen lute. In any case, the purifiers ought to be under cover. The author also spoke about purification by oxide and lime. He (Mr. Bridge) had four boxes for oxide, 25 feet square, and four boxes for lime 20 ft. by 11 ft. He used oxide first, and lime after. He might say that they were under no stipulations at Doncaster as to quality; he was the only inspector (laughter); and no fault was found with the gas, except perhaps occasionally in the winter time. They used no enrichment; the coal carbonized being a high-class South Yorkshire coal, which yielded 18 or 19 candle gas on the works.

Mr. H. Wimhurst stated that they were building at Sleaford a complete new works. He noticed that Mr. Drage gave in his paper storage for four months' coal supply. But they had come to the conclusion that nothing less than storage for six months' supply would satisfy their demands; and in this he thought they were erring in the right direction. As to the retort-house, he believed with Mr. Drage that, in works making under 25 million cubic feet per annum, beds of six retorts were quite sufficient. He, however, differed with him as to the height he gave for the hydraulic main from the retort-bench. In his new works, he (Mr. Wimhurst) had gone 3 feet from the bench to the underside of the main. With 14-inch front walls, his own opinion was that 6 to 9 inches was sufficient space for the ascension-pipes, if they were of ample capacity—say, not less than 6 inches in diameter. As to anti-dips, he should not advise anyone to go in for them. He had experience with them some eighteen months ago, when using Cathels and Thomas's arrangement; and they had, with Newcastle coal, stoppages day after day. They were working high heats and carbonizing a high-class coal; and they were troubled day after day with pitch in the hydraulic main, and most days they had to remove the top of the main in order to clear it out. The hydraulic mains they were now working at Sleaford were provided with flushing-out valves; so that they could empty them whenever they liked, and flush them out either with water or strong ammoniacal liquor—say, once a week. The whole of the tar was taken from the bottom of the main as it was made, and the liquor ran off at the top—the gas passing in another direction to the foul main. He thought that rotary exhausters were far more simple and better than those of the reciprocating type. Referring to purification, he said that at Sleaford he purified exclusively with lime; but he did not know whether, when they had their new purifiers, they would continue that. He found that for lime alone, not including labour, they could purify a million cubic feet of gas, at a cost of a £1. They had a ready sale for the spent lime; and obtained for it from 4s. to 5s. a ton. He concluded by saying that, when his new works were complete, it would give him great pleasure to invite the members to Sleaford to inspect them.

Mr. E. S. Pike (Colchester) said that, in constructing gas-works, it was very necessary that every care should be taken, as any mistake that was made in the beginning was carried on, and had to be dealt with year after year. In gas-works, one mistake was the erection of the buildings too close together. On one occasion, he suggested several alterations at a gas-works; and he was told that the Directors preferred to have the works "compact." That was just the fault he found with them. It was not always wise to keep the buidings too close together. Gas-works would grow, notwithstanding oil and the electric light; and the time came when the demands exceeded the capacity of the works. Then they had to make them larger; and the compactness of the works was found to be a real disadvantage. He knew of several instances where retort-houses had been built with ample capacity for the winter time, and a reserve bench; but he thought that was not enough. A good margin should always be left in a retort-house, because after all it cost very little more to build a retort-house of larger dimensions than a small one. It was really only the side walls they had to extend, as the end walls would anyway be built; and whatever spare space there was could be utilized as a coal-store, and so nothing was lost by it. A great deal had been said about stopped ascension-pipes. The distances given in the paper by Mr. Drage for the position of the hydraulic main and ascension-pipes from the retort-bench were perhaps too small. Stopped pipes were like the poor—they were always with them; and they were very erratic. They might work seasons without a single stopped pipe; and then even with the same coal and retorts, they would be troubled. But while they had the same coal and retorts, they might not have the same men; and he believed that one-half the difficulty that was caused by stopped ascension-pipes was due to the manner in which the retorts were charged. For two or three seasons, he had been troubled with stopped pipes at his works; and he had kept two or three men doing nothing else but clearing them. He came to the conclusion that the temperature of the retorts was really the cause of the difficulty. Some kinds of coal being smaller and lighter than others, if they had a high temperature in the retort, the gas was given off very fast; the small particles of the coal were mechanically carried forward to the ascension-pipes; and many of the lighter oils in the coal were burnt out, and very little besides pitch was left. He had placed his men on eight-hour shifts; and the consequence had been they could not get their work forward. He found previously that the charges were got forward at night, in order that the men should get done earlier in the morning; and this was the cause of the stopped pipes. He worked the men rather less hours; and with similar coal and the same retorts, he had not had a single stoppage. It was always well to keep the hydraulic main a good distance from the top of the retort-bench. It had been his practice for some years to carry the hydraulic main on separate iron girders across the top of the bench, at least 4 ft. 6 in. to 5 feet from the top. This was not the case in his present works, as the benches were constructed before he went there; but it was a practice that might be followed without going very far wrong. If they put the hydraulic main on the retort-bench, expansion and contraction very soon occurred. As to keeping the purifiers and materials under cover, that was the correct thing to do, not simply for the reason that it prevented the freezing of the lutes of the purifiers, but they were able to keep the gas at a proper temperature. It was a mistake to allow the gas to get too cold in the purifiers. There were not many chemical actions that could go forward as they should do, if the gas was kept too cold. If they compared the cost of purifying gas in the summer and in the winter, it would be seen that they could deal with treble the quantity of gas in the summer as in the winter, with the same cost for oxide.

Mr. Drage, replying to the discussion, said, with reference to the site of the works and the remarks in the paper as to sewage works and steam-rollers, he had left out something about the pressure not being quite so high for the low level as for the high. At one of their Cambridge meetings, Mr. Valon stated that he did not think it made any difference whether the works were in the high part of a town or the low. He (Mr. Drage) differed from that view. His old works were in the high part of the town, and the new ones in the lower part. With the works at the high level, he had to maintain a pressure of 2½ to 3 inches; while, with the same governor, he kept it now at about 15-10ths pressure. In the case of leakage and breakages by steam-rollers, this was a consideration. Then with regard to floods, any one building new works would make provision for carrying off the water. As to retort-settings, with his regenerative furnaces, the cutting on the retorts was very sharp; and what the heat would do if he had a centre one, he did not know. Besides by leaving out the seventh retort, he obtained a more extensive combustion chamber. He had lately had the arch turned over the furnace (as illustrated by Mr. Child at their Yarmouth meeting last year), and so made the combustion chamber larger. He found he obtained a higher heat with that arch than without it; and that the greater the combustion chamber, the better the heat. Regarding the ascension-pipes being 6 inches from the front wall, he meant the back of the pipe. With a 6-inch pipe, and allowing 3 inches for the mouthpiece, would make 15 inches that the pipe was outside the retort, at what might be called a dead-heat. If the pipe was fixed 12 inches from the wall as suggested by Mr. Jolliffe, it would make a total of 21 inches. He did not say in his paper that the hydraulic main should only be 1 foot above the bench, but "at least" one foot. Respecting anti-dips, he had them in use; but he should not advise anyone to go in for them. His retorts worked some eight months without requiring scurfing. He believed with other speakers that stopped pipes depended to a large extent on the coal. He was using Mirfield coal at present; and he had only had three stopped pipes during the winter. In regard to exhausters, the reciprocating type drew the tar through the packing, and caused a deposit on the slides if great care was not taken. He saw one at the Lincoln Gas-Works; and Mr. Carter's assistant (Mr. W. H. Manwaring) told him that they had tried several kinds of packing, but they could not prevent the tar being drawn into it. On the matter of purification, he said they formerly used all lime, which used to cost 9d. a bushel, or about £50 a year. Last year lime cost them about £6 10s.; and the cost of the oxide made the expenditure for material about £15. He could not give any definite figures as to the cost of labour for purification. He preferred to pass the gas through the oxide first and the lime afterwards; so that the latter might remove all the carbon bisulphide. The illuminating power of the gas at East Dereham was supposed to be 15 candles. But the consumers wanted 18 candles; and if it dropped down to 16 candles, they soon heard of it. He used more lime than he really would do if he had his own way; but as it made 1 or 2 candles difference in the illuminating power, it was better for them. Regarding the Lyon syphons, his purifiers worked with the common rack valves. The gas went in one side and came out the other; and he was always having trouble with those valves. They would not shut down as they should do; and there was a certain amount of leakage. By putting a Lyon syphon there, when the purifiers required emptying, they had simply to pour in two or three pails of water according to the size of the syphon; and it acted as the best valve of the two. He also made it a practice to use them for testing the streets for leakages every year; and he had reduced the leakage account from 35 to 12 per cent.

A vote of thanks was passed to Mr. Drage for his paper.

MODERN GAS LIGHTING.

At the concluding meeting for the session 1894-5 of the Cleveland Institution of Engineers, held at Middlesbrough on Monday evening of last week, Mr. DAVID TERRACE, the Gas Engineer of the Middlesbrough Corporation, read a paper on the above subject, of which the following is an abstract:—

The author commenced by remarking that, when William Murdoch, in 1792, first utilized coal gas for illuminating purposes, he could have had no conception of the part it would play in the civilized world. His invention, which was free and unencumbered with patent rights, had been destined to take rank with that of the steam-engine. Murdoch's discovery not only added to our material light, but the bye-products from the manufacture of coal gas had benefited, and were essential to a great many of our industries and sciences. Notwithstanding all its advantages in respect of its inherent energies, not more than 5 per cent. of the constituent parts of coal gas, as ordinarily used, were converted into light. The bulk of it when used for lighting was still turned into heat, which was not wanted, and only a small proportion into light, which was required. Recently, however, inventions had been brought forward by which 20 per cent. of the energy in light could be used by first converting it into heat, and then by incandescence into light. The author asserted that consumers generally do not get the best results, for they take no trouble to adapt the burners for securing all the light obtainable. They ignore the circumstances of locality, the dimensions of the house piping, the kind and condition of their gas-fittings, and the amount of available gas pressure. And if they do not get sufficient light through the bad burner and bad globes employed, the gas itself is blamed.

Mr. Terrace then proceeded to describe the special characteristics of a bad burner; taking first the union-jet burner as the type of the open flame, where the appearance of the flame is very wide in proportion to its height; the centre of the flame—*i.e.*, the dark part—being a large area in comparison with what should be the white part. Such burners are wasteful. If consumers were to use good Argand burners similar to the standard burner, they would obtain a near approach to the stated illuminating power.

The author then dealt with the question of the enrichment of gas, and held that it should not be necessary to introduce means of enrichment, as these could only be had at enhanced cost, without a corresponding gain to the consumer. For instance, with Durham coal, yielding, in good practical working, gas of some 15 or 16 candle power, and sold at about 3s. per 1000 cubic feet—*e.g.*, 1½d. per candle per 1000 cubic feet—it should not require to be enriched to 16½ or 17½ candles, as this extra 8 to 10 per cent. increase would not be worth what it cost to the consumer, as, principally on account of the generally defective means of consumption, the normal duty would not be obtained from the enriched gas.

Having dealt with the albo-carbon lamp and regenerative gas-lamps, the author proceeded to describe the Welsbach incandescent gas-light. He stated that the discovery of the mantle originated in an attempt to invent a substitute for the carbon filament of the incandescent electric lamp, which would incandesce in air without being destroyed or burnt. The duty evolved by this burner was six times that of the Argand. From a hygienic point of view, the advantage was very great. The *Lancet*, after a series of experiments, found that the vitiating of the air in an ordinary room was less with the incandescent than with any other form of gas-light, even than by the Bunsen burner alone, using the same quantity of gas.

A short discussion followed the paper.

THORIUM.

The *Chemiker-Zeitung* for April 17 has an original article by Mr. R. J. Gray, of New York, on the sources of thoria, now so greatly in demand for the manufacture of mantles for incandescent lighting. Some explicit information on the minerals yielding thoria and the other rare earths is the more necessary, as much that is erroneous has been published by analysts who have not had sufficient experience of the examination of these minerals to obtain reliable results.

The text-books give very scanty treatment to these earths; and they are seldom referred to in the lecture-theatre. Thorite is the most suitable mineral for the production of thoria; but it is far too scarce to be practically used. The more abundant minerals—such as gadolinite, samarskite, aeschynite, and monazite—alone come under consideration. These do not occur to a very considerable extent in Europe; but they crop up in all parts of America. Monazite has attracted most attention recently. It is found in limited amount in Canada, Connecticut, Yorktown (Winchester County, New York), Carolina, and Virginia; and in greater quantity in Brazil. Its composition varies very greatly as far as the valuable oxides are concerned; and the text-book statements are here especially misleading. According to Gray's analyses, the best washed monazite contains from 35 to 70 per cent. of oxides of the cerium group of metals; from 0 to 5 per cent. of the oxides found in ytterbite; and from 0 to 9 per cent. of thoria. The North American monazite occurs in finely formed crystals. It consists almost solely of the phosphates of oxides of the cerium group of metals, along with traces only of yttria, and from 0 to 1 per cent. of thoria. The Brazilian monazite, on the other hand, is mostly finely rounded amber-coloured fragments, or in some cases massive liver-coloured nodules, often speckled with bright yellow particles (orangite?). The finely powdered Brazilian sand contains as much as 2¾ per cent. of thoria, and 5 per cent. of the oxides present in ytterbite in well-washed samples; while the nodules rarely contain under 5 per cent. of thoria. Throughout America, the mineral is found embedded in a gneiss-like rock, which has also dispersed through it zircon, rutile, xenotime, samarskite, columbite, thorite, orthite, chromite, magnetite, corundum, titanite, diamond, and gold. By weathering, portions of the original bed are loosened, and then washed away from the hills into the plains; then, becoming enriched by the natural washing process of the streams, the minerals are found in the mud or sand. The large quantity of monazite on the coast of Brazil has only a nominal value; but fine sand is found at Antioquia, Bahia, Minos Geraes, Caravellas, and San Pedro. The monazite nodules mentioned above as rich in thoria and yttria, are found in inexhaustible quantities, along with thorite, orangite, fergusonite, and other minerals containing up to even 70 per cent. of thoria, in the diamond-fields of Rio Chico, Villa Bella, Cuyaba and Goyaz. Minerals not of the monazite group, but rich in thoria, are found in realizable amounts in the above districts, and also at Sao Paulo and Corumba in Brazil. In several of these districts, German firms have taken up the procuring of these minerals for technical purposes.

Below are given the percentages of the rare earths contained in well-washed samples of the minerals, and not merely in selected portions, from various sources:—

Source of Mineral.	Oxides Present in Cerite. Per Cent.	Oxides Present in Ytterbite. Per Cent.	Thorium Oxide. Per Cent.
Quebec	50·2	4·5	1·10
Connecticut	61·0	—	1·40
North and South Carolina.	58·0	—	0·32
	63·3	0·1	0·80
	39·0	—	0·23
Bahia	53·0	1·2	1·20
Minos Geraes	51·0	2·2	2·40
Rio Chico	53·0	3·2	4·80
Villa Bella	62·4	4·4	5·30
Goyaz	64·1	5·1	7·60

In America, the interest in the minerals containing thorium and yttrium has considerably decreased since it has been found at electrical works that attempts to impregnate the films of incandescent lamps with the oxides, so as to produce a pure white light, have failed; while trials of diminutive arc lamps have given better results. The Welsbach Company have secured a monopoly by patents to the end of the century; but the electric light before then will begin to displace the incandescent gas-light. (Mr. Gray here is, of course, expressing the opinion of electricians.)

Federated Institution of Mining Engineers.—A general meeting of the members of this Institution will be held at the Society of Arts on Thursday and Friday next, under the presidency of Mr. W. N. Atkinson. Among the papers to come before the meeting are the following: "Blasting Explosives," by Professor Vivian B. Lewes; and "The Composition of the Extinctive Atmospheres Produced by Various Flames and by Respiration," and "The Composition of the Limiting Explosive Mixtures of Various Gases with Air," by Professor F. Clowes.

The Enrichment Value of Butylene and Acetylene.—In Professor Lewes's reply to the discussion on his paper on "Acetylene," as given in the JOURNAL last week, he stated that the enrichment value of butylene was practically the same as that of acetylene. In his succeeding remarks, in explanation of this, we reported him as saying that, when butylene was breaking up, there were in the compound four atoms of carbon and six of hydrogen, which gave two molecules of acetylene. He has since pointed out that the hydrogen atoms should have been given as eight. The two molecules are practically halved in their illuminating power; and hence the total enriching value of acetylene and butylene is the same.

The Cost of Producing Acetylene Gas.—In a recent number of the *English Mechanic*, a correspondent related how, fired by the description which had been given of the method of making acetylene gas from calcic carbide, he had tried to procure some of this material and failed. He next went to a wholesale manufacturing chemist, who told him it was not to be obtained in this country, and that in France only one man had it, and he was willing to sell it at £20 per pound. The chemist added that he was then forming a Syndicate for working it, and that it would shortly be sold at probably a few shillings a pound. (This gentleman may have been referring to the Company noticed in the JOURNAL last week, p. 1085.) The correspondent said he was "waiting for the good time to come." Mr. Frank Wright, of Old Queen Street, Westminster, who has called our attention to the paragraph in question, points out that calcic carbide at £20 per pound means £44,800 per ton; and at 2s., it would come to £224. He remarks that, even at the latter figure, its use for the lighting of bicycles would be a somewhat expensive luxury.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Sloping Retorts at Brentford.

SIR,—After my paper on "Sloping Retorts" had been read at the recent meeting of the Institution of Gas Engineers, the question was asked: "Why was there less make and no difference in the cost of carbonizing?" The years 1890 and 1891 being mentioned, I could not answer at the time, as Field's "Analysis" introduced the Southall station. Since the meeting, I have worked out the coal carbonized by sloping retorts at both stations. I find that, in 1890, two sets were picked up at Southall, and they worked through 1891. The next sloping retorts were picked up at Brentford in September, 1891. They worked three weeks, when the crowns of the combustion chamber arches dropped a little. We had to stop the centre lot, and re-arch the combustion chamber, which took ten weeks. They were picked up again in December, 1891. At the same time, twelve new sets were picked up at Southall. Thus I find about 4 per cent. only of the total coal was carbonized in "slopers." More sets were picked up at Southall in January, 1892. I find that, of the total make in 1892, 50 per cent. of the coal carbonized was in "slopers." I notice in Field's "Analysis," a saving shown of about 8d. per ton for 1892. The wages on horizontal retorts remaining the same, this shows a saving on the "slopers" of 1s. 4d. a ton, as half the coal was carbonized in these retorts. The following figures, taken from Field's "Analysis," may be of interest:—

	1890. Cub. Ft.	1891. Cub. Ft.	1892. Cub. Ft.	1893. Cub. Ft.	1894. Cub. Ft.
Gas made . .	10,770	10,314	10,239	10,235	10,190
Gas sold. . .	10,173	9,779	9,605	9,542	9,624
Cost of carbonizing per ton of coal . .	4s. 4·5d.	4s. 3·99d.	3s. 7·8d.	3s.5·35d.	3s.4·2d.

Brentford, May 17, 1895. J. HUSBAND.

SIR,—I have perused with great interest and profit the series of papers read at the recent meeting of the Incorporated Institution of Gas Engineers. The paper by Mr. Husband on "Sloping Retorts," though satisfactory in some of its particulars, contains in its last paragraph, as given on p. 1078 of last Tuesday's JOURNAL, a reference which, to an outsider like myself, is quite meaningless and incomprehensible. I should like to ask the author of the paper for some explanation, which he might kindly give through your columns. For what reason were the drawings referred to in that paragraph sent to a Company who are supposed by some to hold certain patent rights? Was it to show that these questionable rights had not been violated by the installation at Brentford? Or what was the reason?

Seeing that there are, no doubt, many engineers at the present time, who have under consideration the adoption of the inclined retort system, a reply to these questions seems to be urgent; for it may help to the elucidation of the point as to whether any royalties may justly be demanded by anyone for the future use of inclined retorts.

7, Drapers' Gardens, E.C., May 22, 1895. C. E. BRACKENBURY.

Water Gas at Tottenham.

SIR,—In commenting on Mr. Broadberry's paper in the last number of the JOURNAL, you say (and the analysis would seem to indicate the same) that, though the water gas contained, in its crude state, 6 per cent. of carbonic acid, it had been "wholly removed by purification before the combined gases were sent out." As the water gas was only sent through the oxide purifiers, it would be interesting to learn how the disappearance of the carbonic acid is to be accounted for; or must it rank as unaccounted-for gas? I also notice, in the summary of the cost per 1000 cubic feet, that, though it treats of "water" gas, there is no item for water. Yet 67 gallons cannot be had for nothing. In some places I know of, in fact, the cost of it would cut a far more respectable figure than that opposite the item "ash sold."

Having, by Mr. Broadberry's kind permission, seen the plant, I would add that it seems most admirably arranged, and to be all that he claimed for it.

Cork, May 24, 1895. THOS. P. TRAVERS.

The Labour Question.

SIR,—It is palpably the duty of every person at the head of a gas company to try to build the interests of his shareholders upon a certain and sure foundation; and it must have been a pleasure of no ordinary kind with which many of your readers recently read the correspondence on the above question which took place between Mr. Livesey and gentlemen of opposing views. The report of the debate on the workman-director proposal at the recent meeting of the Institution of Gas Engineers was also most instructive. There is no denying the fact that the subject has now reached a most acute stage, and is a stern and grim reality. The Education Act of 1870 is fairly beginning to have its effect upon the general workers of 1895. They are no longer willing to serve the best years of their lives for even a "living wage," and to be relegated in their later years to either the charity of their friends or the workhouse. Why not recognize this state of affairs, look the question fully in the face, and grapple with it?

The strike at the South Metropolitan Gas-Works was big with pathos; and though the Gas Workers' Union was beaten—and, under the circumstances, deservedly beaten—yet Mr. Livesey saw that its recurrence was simply a matter of time. He has since attempted to avoid this *contretemps* by a stroke of high policy and wisdom in endeavouring to make the interest of his shareholders, employees, and consumers practically one. He has already arrived at the *copia fandi*; but in his efforts to attain the *copia verborum*, he finds himself attacked and half strangled by Old Men of the Sea. The latter will, no doubt, share the fate of their ancient and interesting prototype; but while this event is maturing, much harm may be done to our industry.

Surely many gentlemen of supposed eminence in the gas profession might do something to bring this question to the front, and effect, at least in our generation, a final settlement of it. There has not yet appeared in your columns any argument against Mr. Livesey's proposal worth the paper on which it has been written. Platitudes are, in this instance, perfect nonsense, and worse than nonsense. The whole labour world is like a seething cauldron; and yet we are told that a late moderate and reasonable proposal to settle the matter finally, which is acceptable both to the workers and to the Board of Trade, is dead, and is hoped to be soon buried.

There was a foolish old king once called George the Third, who, by his bigoted, short-sighted, and high-handed policy, lost the whole of the United States of America to the British Crown. Is a similar policy to prevail with us now? If so, it may shortly be a bad look-out for investors in gas stock. Instead of there being a proper debate upon the subject in the JOURNAL, the whole matter appears to have dropped after a puerile attempt, as it were, to *sauter le coup* on Mr. Livesey. Let us hope that no labour Napoleon will, in the interim, arise; for, if so, many an Austerlitz and many a Jena will fall at the feet of the conqueror ere the latter finds his St. Helena at the works of the South Metropolitan Gas Company.

Heckmondwike, May 24, 1895. A. F. GOODSON.

Stafford Corporation Gas Supply.—The Gas Committee of the Stafford Town Council announce an increase of 9·78 per cent. in the sale of gas during the year ended March 25 last. This is the largest growth of consumption the Committee have ever reported. The gross profits amount to £7812; and, after allowing for the repayment of the principal and the payment of interest on loans and other necessary charges, there is a balance of £1500 in relief of the rates.

The Additional Storage for the Bridgnorth Gas-Works.—With reference to the paragraph on the above subject in last Tuesday's JOURNAL (p. 1084), we learn that the contract for the 115,000 cubic feet gasholder on the Gadd and Mason principle, with a steel-lined tank, therein mentioned, has been let to Messrs. R. and J. Dempster, Limited, of Manchester, at a price a little below the estimate of the Consulting Engineer—Mr. Belton, of Shrewsbury—which was £1800. This figure was, by an oversight, given last week as £18,000—an obviously disproportionate amount for the size of the holder.

Fatal Explosion of Gas.—Mr. G. Nutt Creassey (aged 65), of Alexandra Park, Nottingham, has died from injuries sustained through an explosion of gas at his residence on the 13th inst. The evidence tendered at the Coroner's inquiry last week showed that the deceased gentleman became aware of an escape of gas on the morning of the above date. Having discovered its whereabouts, he opened the windows, and left them so for a considerable time. The precautions Mr. Creassey took, however, proved insufficient; for, on subsequently lighting a match to burn out the gas which might have been left in the pipes, an explosion occurred, which seriously burned and otherwise injured him. The jury returned a verdict of "Accidental death."

The Huddersfield Gas Undertaking.—The gas profit realized by the working of the gas undertaking of the Huddersfield Corporation, which is under the supervision of Mr. W. R. Herring, in the year ending March 31 last amounted to £19,603, which has been appropriated as follows: Interest, £11,615; redemption fund, £1533; reconstruction of water fund, £6455. During the year, there was an increase to the extent of 3 per cent. in the consumption of gas. Notwithstanding this fact, however, the receipts were less by £3134; the loss being chiefly attributable to the decreased value of coke and sulphate of ammonia. With regard to the expenditure, there was a net decrease of £4391; while with respect to the items representing manufacture, apart from interest, rents, rates, and taxes, there was also a decrease to the extent of £7161. The average price received for gas, less discount, was 2s. 4½d. per 1000 cubic feet.

A Gas-Stove Explosion at Leicester.—Last Thursday morning a gas explosion of an extraordinary nature occurred at the house of Mr. H. B. Bruce, a member of the Leicester Town Council. The cooking-range of the kitchen consists of a fire-place with an oven on either side, one of them being heated with gas. On the morning named, Mrs. Bruce lighted the gas under the oven, and closed the door. A few minutes later, while she was standing at the table near the fire-place, a loud explosion occurred. The oven door was blown across the room in an oblique direction, whilst a portion of the latch struck the wall. The iron fender in front of the fire-place was broken in two places; and the table legs received numerous indentations from the flying fragments. Mrs. Bruce fortunately escaped injury, though she naturally received considerable shock. It is surmised that the closing of the oven door extinguished the lighted jets; and the escaping gas became ignited by the fire which was burning in the grate. The explosion must have been a violent one, as the iron door was thrown a distance of several feet.

The Collection of Gas and Water Accounts at Manchester.—There was a short discussion at the meeting of the Manchester City Council last Wednesday, upon a motion by Mr. Greenhow that it be an instruction to the Gas and Water Committees to report as to the advisability of making arrangements whereby the accounts of the two departments could be collected by one staff of men. He maintained that a material saving would be effected by adopting his proposal, and suggested that the system might be extended to the collection of the poor-rate. It was stated by Sir B. T. Leech that a Committee thoroughly investigated this matter some ten years ago; and they came to the conclusion that they could not recommend the amalgamation of the collection of accounts. It was found that Manchester was not situated the same as other towns where the system had been adopted. For instance, they supplied with water eighteen districts which were not served by them with gas. The motion was opposed on behalf of the Gas Committee by Alderman Higginbottom; and Alderman Hoy suggested that Mr. Greenhow should withdraw his resolution, and look a little farther into the matter. After consultation with his friends, he might then think it desirable to bring in a wider resolution, which would give the opportunity of appointing a Committee who could make a broader survey of the whole question than could be possible under the present resolution. Mr. Greenhow acceded to the suggestion.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Private Bills last week:—

Bills read a second time: Bray Township Improvement Bill, Gas and Water Orders Confirmation Bill, Water Orders Confirmation Bill.

Bill committed: Gas Orders Confirmation Bill.

Bills read the third time and passed: Brymbo Water Bill, Scarborough Gas Bill, York New Water Bill, Whitby Water Bill

HOUSE OF COMMONS.

Monday, May 20.

ELECTRIC LIGHTING IN LONDON.

Mr. HAZELL asked the President of the Board of Trade whether the Board had declined to grant Orders in the Metropolis unless the power of purchase by the local authority was reserved at the end of 42 years from Aug. 22, 1889, under the terms of sub-section 2 of the Act of 1888; and whether, as the period of 42 years was now reduced by nearly seven years, and was daily diminishing, the President would consider the desirability of giving the Companies more favourable terms.

Mr. BRYCE: Yes, sir; that is so. But section 2 of the Electric Lighting Act, 1888, provides that the local authority may purchase the undertaking after the expiration of a period of 42 years, or such shorter period as is specified in the Provisional Order. The Board of Trade have held that it is in the interest of London that the power of purchase by the authority or authorities shall, as far as possible, operate at the same date over the whole of the Metropolis. To this policy the Board of Trade adhere. The time does not seem to have arrived when it becomes necessary to consider whether any relaxation in the terms on which such undertakings may be purchased may require to be made, in order to render it worth the while of companies to enter upon new enterprises.

Tuesday, May 21.

ELECTRIC LIGHTING REGULATIONS.

Mr. WEIR asked the President of the Board of Trade if he would state why private electric lighting companies are permitted to run their mains over any public street or thoroughfare, and are under no obligations, either to their own consumers or the public, while vestries are bound to lay their mains underground and conform strictly with the rules of the Board of Trade; and whether, having regard to the fact that local authorities consider mains carried across public thoroughfares a source of danger to the public, he would take steps to require private companies to conform with the regulations applicable to vestries.

Mr. BRYCE: My honourable friend is not correctly informed as to the state of the law. Private electric lighting companies having statutory powers are under obligations similar to those imposed on local authorities, and are also prohibited from using overhead wires without the consent of the Board of Trade and the local authority. Private electric lighting companies not having statutory powers are subject to regulations for the protection of the public safety prescribed under the provisions of the Electric Lighting Acts, 1882 and 1888, though the use of overhead conductors is not prohibited by those Acts. Moreover, urban authorities, under the Public Health Act of 1890, are empowered to make regulations for the prevention of danger or obstruction to the public from wires stretched over, along, or across any street.

The following progress was made with Private Bills last week:—

Bill presented and read the first time: District Councils Water Supply Facilities Bill, "to give facilities to District Councils and landowners to charge estates for providing supplies of pure water thereto."

Bill read a second time and committed: Merthyr Tydfil Local Board Water Bill.

Bills read the third time and passed: Brighouse Corporation Bill, Hebden Bridge and Mytholmroyd Gas Board Bill.

The Examiner reported that no Standing Orders were applicable to the London Water-Works Transfer (Money) Bill.

Hebden Bridge and Mytholmroyd Gas Bill.—This Bill recently came before the Committee on Unopposed Bills in the House of Commons. The object of the Bill is to incorporate and constitute a Gas Board for Hebden Bridge and Mytholmroyd, and transfer and vest in the Board the undertaking of the Hebden Bridge Gas Company, to authorize the Board to borrow money, and for other purposes. The Hon. Chandos Leigh, the Speaker's Counsel, stated that the Company proposed to be transferred obtained powers in 1894; and it was suggested that a Joint Board should take over the undertaking. The Bill had been through the House of Lords; and the only point he was not satisfied about was that while in 1894 the price was fixed at 3s. 6d. per 1000 cubic feet, with a sliding-scale, it was now put at 4s. 6d. without any scale. Mr. Corbet Woodall, for the promoters, said the advance in the maximum price was not unusual when an undertaking was acquired by a local authority. It did not follow that any such figure would be charged; but a local authority had the right to protect itself against any unexpected rise in the price of coal or any circumstances that might entail loss to the ratepayers. The explanation was accepted; and the Bill, as amended in certain particulars, was passed, and ordered to be reported.

HOUSE OF COMMONS COMMITTEE ON LONDON WATER BILLS.

Before the Right Hon. D. PLUNKET (*Chairman*); *Sir* J. KITSON, *Sir* H. STAFFORD NORTHCOTE, *Mr.* BALDWIN, *Mr.* BURNIE, *Mr.* MUNTZ, *Mr.* P. STANHOPE, *Mr.* AINSWORTH, *and Mr.* HOLLAND.)

Fourth Day—Friday, May 17.

Mr. *C. Harrison*, resuming his evidence-in-chief, stated that the two Companies now under the consideration of the Committee—the Lambeth and the Southwark and Vauxhall—formed a complete system of supply for the southern portion of London. Among other divergencies in the position of the Companies which led the Council to proceed by separate Bills, he mentioned that, while some of them were not taking so much water from the Thames as their statutory rights permitted them, the Lambeth Company, for instance, had exceeded their powers. The Council had endeavoured to negotiate with the Lambeth Company for a purchase by agreement; but the Directors replied that they did not consider they had power to enter into such negotiations. The Conservators of the River Thames last year opposed the Companies being allowed to draw from the Thames Valley more water than they were entitled to under statute; and in that course the Conservators were acting up to their Act of 1891, by which they were bound to use all lawful and proper means to preserve and maintain the flow and purity of the Thames. Londoners were largely interested in this question, apart from the taking of water for dietetic purposes, as it was necessary that the Thames should be kept up as a navigable river and for purposes of recreation. The County Councils of the outside districts also objected, in their petitions, to further quantities of water being abstracted from the Thames; and the Local Government Board, in their report this year, also urged that the quantity of water taken from the Thames should be restricted. As to the legality of the charges of the Companies, he urged that they were not made in accordance with the necessities and wants of the people, but that the maximum rate was levied upon the rental value of the property supplied, which was, in fact, a local taxation upon the occupiers. The clauses giving directions to the Arbitrator were put to the witness *seriatim*; and upon each of them he expressed the view that they were reasonable and fair. He concluded by stating that, in the view of the Council, there would be a very considerable administrative saving in the management if the water undertakings were transferred to them.

Cross-examined by Mr. PEMBER, for the West Middlesex Water Company, witness stated that the Council sought to be the Water Authority for the whole of London, and that along with this should go the necessity for the purchase of the undertakings of the eight Companies; or the Council could make other arrangements.

Mr. PEMBER: Do you contemplate being the Water Authority without purchase, if you cannot get such terms as you like?

Witness said they did, if they could not get what they considered equitable terms such as they had submitted in the Bills.

Then do I understand that, unless you get your way about the arbitration clause—for that is what it comes to—you claim the right to drop all the Bills, and still to become the Water Authority for London?—I do not know what might happen as to the future course of action of the Council as the result of the passing or non-passing of the Bills.

Unless you buy these undertakings, you will not be the Water Authority for London?—That is obvious.

In further cross-examination, witness stated that the Council proposed to proceed with all the Bills; and the reason the second reading of the other six Bills had been postponed was to save the unnecessary attendance of parties. Being pressed on this point, he admitted that all the parties were now represented.

Mr. PEMBER, appealing to the Committee, asked whether their declaration in favour of a single representative Water Authority for the Metropolis prevented him from going into the principle of the question whether there should be a purchase at all. The four Water Companies for whom he appeared—and he thought he might claim to represent them all—protested against the compulsory purchase of their undertakings; and they would be prepared to discuss this principle with Parliament, if Parliament were ready to discuss it. But he rather gathered, from the decision at which the Committee had arrived, that they did not consider the principle of whether the works should be purchased upon certain terms, and by some body or another, was open to question.

The CHAIRMAN said he had never heard any other means of making one central authority for the purpose suggested, except that of purchase; and therefore Mr. Pember must accept the principle of purchase as included in the decision the Committee had given, unless he could propose some alternative of which the Committee had not heard.

Mr. PEMBER said he bowed to this decision; but the only thing he wished to make clear was that the whole of the Companies were unwilling to sell. They were unwilling sellers, and must be so treated.

In further cross-examination, witness stated that he believed an Arbitrator, considering "all the circumstances of the case" with a view to seeing what money should be paid, would take into account the state of repair of the reservoirs and filter-beds, and other matters; but he would not necessarily consider any liabilities or obligations in connection with the undertaking which the Company might be reasonably expected to incur. He would only regard those liabilities and obligations *de facto* existing, and not the future wants and calls which there might be on the existing works.

Mr. PEMBER: Of course, if there were arbitration on the terms of all the circumstances of the case being considered, you would expect, would you not, that the Companies would claim not only for their present but their prospective value?

Witness: Oh, yes.

If a Company claimed prospective value, would it not be absolutely necessary for the Arbitrator to take into consideration any liabilities or obligations connected with their undertaking that might reasonably be required or expected to be incurred, which would minimize the possibility of their having any prospective value at all?—Yes.

Supposing I said for one of these Companies: "My income is £100,000 a year now, and it will be increased to £120,000 in the course of the next ten years, and I must be paid for the chance I have of making the extra £20,000 a year." Would it not be absolutely impossible for

the Arbitrator to avoid taking into account, as against that possibility of increase of income, the fact that I might have to spend £200,000, £300,000, or £400,000 to earn it?—It might be so; but it does not follow that what is reasonably required might be expected. This would be wholly irrespective of the wants or liabilities which might be imposed upon a Company who claimed to be in a position to supply an outside area if Parliament would give them the additional powers.

In further cross-examination as to why the Arbitrator should be instructed to consider the "probability" rather than the possibility of the Companies' legal powers being limited, witness said he merely wished the Arbitrator to take the matter into account. He could not point to any precedent in which, if the intake had been sufficient for present purposes, an Arbitrator had been compelled, in an arbitration clause, to consider whether, in some dim and distant future, a change would occur which might make their value less, except the precedent which Parliament had established by shifting the locality of the intake from time to time.

Mr. PEMBER: Then I am to understand that what it really amounts to is this—that a Company who have been authorized by Parliament for many years to draw their water from a particular source, are to be treated as a Company who might be absolutely prevented by Parliament from taking their water from that source?

Witness would not say that, but that the Arbitrator was to have liberty to take it into consideration.

Mr. PEMBER: No; I beg your pardon. He is not to have liberty; but he is to be compelled to have regard to these circumstances.

Witness was further cross-examined with regard to the directions to the Arbitrator; and he expressed the view that it was reasonable that the Arbitrator should take into consideration the circumstances mentioned. Questioned as to the power of the Companies to compete with each other, and as to whether Parliament had not consented to non-competition, he stated that he knew of no such consent.

Mr. PEMBER referred to the Act of 1852, by which the Companies were let off from competition, and asked witness whether, for the last 43 years, Parliament had not consented to, and acquiesced in, the Companies working under a practical monopoly in their respective districts.

Witness admitted that this was so. He also stated that, in 1884, Parliament, by sanctioning non-competition by the Lambeth Company in certain districts, confirmed the proviso of the Act of 1852; but he added that the Act of 1884 only applied to a small spot.

It was the only part of the eight Companies' districts which was not subject to the proviso of the Act of 1852.—I am not aware, nor did I believe, that it was so; because the limits of the Lambeth Company were fixed in 1848, before the passing of the Act of 1852.

In the arbitration clause also, no allowance is to be made in respect of any assumed future increase in the value of buildings in the district, other than the increase due for additions or alterations involving an extra supply of water. Is not that to cut out at once all the prospective value of the Companies?—No.

Would not that proviso have a great effect on the prospective value of the Companies?—I think it would. It was intended to abolish the power of charging the water-rate upon the increased valuation.

In further cross-examination, witness said he thought the non-allowance for compulsory sale was fair, because he did not look upon the sale as compulsory. The whole of recent legislation tended to establish that it was a public necessity that the water undertakings should be transferred; and in that case he did not regard this purchase as a compulsory one. He was aware that in every Private Bill the compulsory purchase of land was always justified by it being a matter of public advantage; but in those cases it was parted with to a commercial company, and not for public purposes. Witness was proceeding to quote Mr. Chamberlain in favour of his view, when

Mr. PEMBER said he had not the pleasure of cross-examining Mr. Chamberlain on that question, but he had cross-examined Mr. Binnie, who was a fair man upon it; and he admitted that it was reasonable that there should be an allowance for compulsory sale. He asked witness if he thought it right, as proposed in the Bill, that the County Council should enter upon the Companies' property before the value had been ascertained.

Witness said he did; and he did not think this would tend to depreciate its value.

I only wish that anyone whose property I wanted to acquire, and to depreciate the value of, would allow me to manipulate it for a year or two. Why should not the Company carry on their undertaking until the money was paid, and then the Council take it over?—There would be such an enormous number of difficulties and adjustments that it would cause very great delay.

As soon as you have entered into possession of our undertaking, you are to take our books. We shall have no more servants—our accounts will be all gone; and we should have no power of inspection of our works to see what is being done?—Inspection is provided for in the Bill.

No; you have the power to inspect our works beforehand. Now, really, considering the complicated character of our property, do you think it is a fair thing that you should be in possession of it for a year, or two years, after it ceases to be ours, before the arbitration takes place?—Certainly.

Well, if you do, you do!

In witness's further cross-examination, it was pointed out that there were four different dates named in the Bill—the date of vesting, when the Council took over the property; the date of the award, which might be a year or so afterwards; the date of the settlement of accounts between the Council and the Company, which would leave a hiatus during which the shareholders would not get any dividend; and the date for the payment of the money. All these difficulties would be avoided if the Council would pay over the money before they entered into possession.

The CHAIRMAN said he did not know if the Water Companies, in any of their petitions, raised the question whether, assuming there was to be some central Water Authority for London, the London County Council was the best authority for the purpose, because Mr. Harrison, in his examination-in-chief, had stated that the Council had plenty of spare time, and that there would be no difficulty in their administering the undertakings.

Mr. PEMBER said he thought all the Companies raised that point; and this was one of the questions with which he proposed to deal on the following Tuesday morning.

Fifth Day—Tuesday, May 21.

In the interval between this and the previous sitting, a further change was made in the constitution of the Committee by the discharge of Mr. Holland, and the appointment of Mr. Christopher Furness (Hartlepool) in his stead.

On the resumption of the proceedings,

The CHAIRMAN said that, on looking through the petitions, he found that several of them raised the point that the London County Council was not a body well qualified for the purpose of a Central Water Authority for the supply of the Metropolis; but he did not find that any of them formulated anything like a counter-scheme. After consulting with his colleagues on the Committee, they had come to the conclusion that they must take the Bill as it was sent down to them from the House, and could not go into any alternative proposals, though it would be quite open to Counsel to cross-examine on the questions of whether the Council was the proper body.

Mr. *C. Harrison* was then further cross-examined by Mr. Pember, as to the difference between the area of the County Council and that served by the Water Companies. Asked whether in the one case it did not represent 121 miles and in the other 621 miles, witness replied that he was not acquainted with the fact. With reference to the agreement which had been come to with the Surrey County Council for the acquisition of the portion of the works within their area, he stated that the Surrey Council was not a water authority; but he would not say that they did not intend to become one. He thought it would necessarily flow from the agreement that they would become an authority for the supply of water. He had not seen the report of the Local Government Board which pointed out that the County Councils outside London had at present no power in connection with water supply to the inhabitants of the districts within their jurisdiction, and that they could not obtain any powers without further legislation; nor had he read the speech of Lord Onslow at a recent meeting of the Surrey County Council, when he said that they could not become a water authority to administer the water supply unless they went to Parliament. He did not imagine that this would be the case; nor did he admit that the agreement with the Surrey County Council as not being a water authority would be *ultra vires*, or that it would be altering general legislation, which defined the powers of County Councils, by means of a Private Bill. Although the agreement provided that the Surrey Council should be present at, and take part in, the arbitration proceedings, it could not be as one of the parties; but they might assist in the way of tendering evidence. Asked as to the direction to the Arbitrator to consider the legality of the present charges of the Company, he said that he did not intend to do more than what the clause expressed—viz., to give power to the Arbitrator to consider the whole question of whether or not the charges were founded on law.

Mr. PEMBER: Suppose he was an ordinary Arbitrator, with an open arbitration clause, and certain charges were claimed by the Lambeth Company, and you said those charges were not legal, the Arbitrator would not decide that without referring it to a Court of Law, would he?

Witness: If the reference was a reference as to the charges and the validity of them, well and good.

Mr. PEMBER said he did not understand the meaning of the answer, and must therefore ask the witness to make it a little clearer. He repeated the question.

Witness: Not in an arbitration as to price, because it would be a matter of law indirectly, but only in the way of enabling him to calculate what the price should be.

Mr. PEMBER: Let me put this concrete case to you: Supposing the Lambeth Company claim to make a certain charge, and, if they were right in their contention, that this fact added, we will say, a million to their claim. If the other side contended that the claim was not legal, it would be absolutely necessary for the Arbitrator to arrive at the fact as to whether it was legal or not. How would he find it out except by going to the Court?—He would decide that in the ordinary way. It is what every arbitrator has to do.

To decide points of law?—To decide in his own mind.

Would not it be perfectly possible for us to say: "Sir, you must not decide that legal point. You must state a case, and take it to a Court of Law"?—I do not think so.

Mr. PEMBER was proceeding to ask the witness what would become of the security of the debenture holders on the undertaking after the London County Council had disposed of a considerable portion of it to the Surrey County Council, who did not undertake a penny of liability to the debenture holders, when

The CHAIRMAN interposed, stating that Mr. Harrison had already said that, if the interests of the debenture holders were not already provided for, he would consent to an amendment of the Bill, and said that in any case they might rest assured that the Committee would see that they were protected.

Mr. PEMBER next questioned the witness as to the existing multifarious duties of the Council; pointing out that, on an average, each member must be on three Committees, and their attendance must be more than once every day of the year. He reminded him that this was the present state of things, although they had not yet begun to work the tramways, to manage the pawnshops, and undertake municipal workshops, all of which were in contemplation. He asked witness if he did not think the Council had enough to do.

Witness: No.

Mr. PEMBER: Still hungry, or, as Mr. Worsley Taylor suggests, on this occasion thirsty, for more work.

Witness said he thought the Council was sufficiently large to manage the government of London in all respects, so far as it was vested in them.

The CHAIRMAN asked witness if, in the direction to the Arbitrator to consider the question of going for a new source of supply, it was intended that he should consider not only with regard to new intakes

from the Thames, but the wider question of the necessity of obtaining a supply from Wales or elsewhere.

Witness said that he thought both questions would be open to the Arbitrator to consider.

Cross-examined by Mr. BIDDER, for the Southwark and Vauxhall and New River Companies, witness said he did not suggest that these Companies were willing sellers; but the question whether they ought not to be treated as unwilling sellers was one for the Committee.

Mr. BIDDER: Being unwilling sellers, do you suggest that we ought to be treated as willing sellers?

Witness said he thought so, looking at the thing as a whole, and at all the surrounding circumstances; and he considered that it would be a public benefit if the transfer took place. He did not think in this case there should be any allowance for compulsory purchase. The case was unique, and could not be guided by precedent in other transfers. Health considerations were more urgent in London than elsewhere.

Mr. BIDDER pointed out that London was one of the healthiest towns in the kingdom, and that the Royal Commission had reported that the quality of the water supplied by the London Companies was of a high standard, so that the latter observation of the witness did not apply. Turning to the question of the Company being allowed to pay back dividends for only six years, he asked witness if, after the Company had been making in some years only 3 or 4 per cent. and in other years nothing, and then they had an opportunity, by the growth of the district and the increased supply, of recouping their losses in the past, it was just by this Bill to sweep away the opportunity?

Witness said that he had already explained that the provision was based upon a similar one in the case of the gas companies.

Mr. BIDDER asked if that was not a bargain made in Parliament, when the gas companies obtained, as a condition for giving up the back dividends, a monopoly which they did not possess before.

Witness said he could not answer for that.

Mr. BIDDER: Take it from me that it was so. Is there any parallelism between that case and this, where you are going to take away our undertakings altogether?

Witness replied that he thought it was a fair proposal.

The CHAIRMAN asked what was the statutory dividend of the Southwark and Vauxhall Company.

Mr. BIDDER said that on the original capital it was 10 per cent., and on the additional capital 7 per cent. Turning to the witness, he asked: Is not the meaning of it this: That a Company in its early days is generally worked at a loss, or at a very bare profit; and the only prospect of profitable remuneration is the future development of the district as years go on?

Witness: Yes.

And providing mains in a suburban district is one great factor in the development of the district?—Yes.

Therefore Parliament, in allowing the Company to take back dividends, is giving them a right to enjoy the fruits of their capital expenditure in the past?—Yes.

Then on what principle of justice do you ask this Committee to put in a proviso which deliberately takes away the fruits of their energy and expenditure, which Parliament gave them in the shape of back dividends?—We base that on precedent.

Can you suggest any principle of morality?—Yes; under the whole circumstances, I think it is a fair and equitable one.

I have carried on the business for a very long time. For many years there has been no return, and for many more only a lean return. I did it on the faith that, as the district grew in value, I should get a substantial return for my money. How can you put in a proviso now which says that I am not to have that return?—There are many considerations as to proper application of capital and proper expenditure; and those are considerations which, in my opinion, make this a fair proposition.

Sir W. MARRIOTT cross-examined the witness on behalf of the Chelsea Company, as to whether or not the arbitration clause in the Bill altered the present law.

Witness said it altered it so far as concerned the position of the purchaser under the Lands Clauses Act.

Sir W. MARRIOTT: Do you consider it fair that a purchaser who wants to make a purchase should alter the law so that he may get the article cheaper from the seller?

Witness said he could hardly answer that question. The object of the Council was not altogether to get the undertakings cheaper; but he thought it would have that effect.

The CHAIRMAN inquired what course the promoters proposed to take after Mr. Harrison's evidence was concluded.

Mr. WORSLEY TAYLOR replied that they next proposed to call Mr. Bassett Hopkins.

The CHAIRMAN: I was going to suggest that the Committee think it might possibly simplify matters if you were to call the Parliamentary Agent, in order that we should see clearly what your contention is on the question as to what matters the Arbitrator may or may not go into if he were not controlled by the provisions of clause 6, because we think possibly it may give us a clearer indication as to the course the inquiry should take in its subsequent stages. If it is not inconvenient, we should be glad to have your view given to us by the Parliamentary Agent, and also the views of the Counsel representing the petitioners, which would no doubt come out in cross-examination. I think you will all see that it is rather an important element in this inquiry; and Mr. Harrison himself admits that this is rather a new phase of the business of an Arbitrator.

Mr. WORSLEY TAYLOR agreed that it was desirable to call the Parliamentary Agent at an early stage. They proposed first to call Mr. Bassett Hopkins, who was a barrister, and who had had the advantage of being on the County Council, and would therefore be able to give evidence on clause 6 as a matter of authority. After that, they had proposed to call the Engineer and then the Parliamentary Agent (Mr. Cripps); but if the Committee preferred to have Mr. Cripps examined immediately after Mr. Harrison, the promoters would call him.

The CHAIRMAN: You can call who you chose first; but if we could at once get a clear understanding as to what your view, and the view of the petitioners, is as to the scope of the arbitration, supposing it were not controlled by these particular sub-sections of clause 6, it might guide us in our course, and possibly save a good deal of Mr. Bassett Hopkins's examination. I think the sooner we get what help we can from yourself and the petitioners from that point of view, the more time it will save.

Mr. LITTLER: I do protest against a new practice which is being brought up of gentlemen being called to explain to the Committee what the English law is. They may do so with regard to foreign law if you like; but as to English law, it should be done by the Counsel, and not by witnesses. I shall object to a single question being asked of Mr. Bassett Hopkins on that matter. Mr. Cripps may tell you what he fears may happen if this clause is not given. But he cannot tell you what the law is; and I protest against any witness being put in that position.

The CHAIRMAN: You need not protest until you hear what we intend to do. We mean to get as much information as we can.

Mr. LITTLER: My protest is quite timely. I know it has been attempted over and over again by the County Council to produce gentlemen to tell you what the law is; and I have over and over again prevented them from doing so.

The further cross-examination of Mr. Harrison was then deferred; and the Committee adjourned till the following day.

Sixth Day—Wednesday, May 22.

Mr. *Harrison* was recalled, and further cross-examined by Sir W. MARRIOTT. He admitted that it was desirable, in the carrying out of large undertakings, that there should be some element of permanency; but he considered that the London County Council had very great permanency about it. Nearly forty of the members (exclusive of Aldermen) who were on the Council six years ago were still on it; and, of course, they would have the permanent staff. He maintained that up to the present the Council had been a good business body, notwithstanding the report of the Works Manager on the question of the cost exceeding the estimates, in which he complained of individual members visiting the works, and entering into conversation with the men, which had a most pernicious effect on them, and diminished the authority of the foreman.

Mr. FREEMAN objected that there was absolutely nothing in the petition of the Chelsea Company on this point.

Sir W. MARRIOTT replied that the cross-examination arose out of the suggestion of the Chairman that they should devote their attention to the consideration of whether the Council was a proper authority to whom the works should be transferred.

The CHAIRMAN said it was quite impossible for the Committee to go into the success or failure of the County Council; and the question did not seem to arise on the Chelsea petition.

Witness said that now they had got rid of the initial charges in connection with the Works Department, he thought it would result in a large saving to the ratepayers.

Mr. LITTLER cross-examined witness, for the Kent Company, with regard to the proposal to limit the payment of back-dividends, stating that for the past eleven years they had been paying back-dividends, and now paid 12 per cent., 2 per cent. of which was in respect of back-dividends. He asked witness whether, under these circumstances, the stock of the Kent Company did not fetch more in the market than it would do but for that privilege granted by Parliament.

Witness said that it was obvious that the more the stock earned, and the more dividend it paid, the more it would fetch. The proposal applied to the whole of the Companies generally, and he had given the reasons why he thought it fair; but he did not know the details of the Kent Company.

Mr. LITTLER: Assume a Company is at the present moment paying 12 per cent., why should you depreciate the actual value of its shares, when it has done nothing wrong?

Witness said that, as the Kent Company's charges were altered in 1864, and put on a standard far higher than in 1850, and as they had absolved themselves from exercising the powers of competition in other districts, all these questions of charges ought to be investigated by the Arbitrator; and so far as they would affect back-dividends, they ought to be affected.

Mr. PEMBER: My powers of charging are one thing, and my powers of back-dividend are another; and I am now dealing with back-dividend. Why should a shareholder who has bought in the market at 20 per cent. more than he would otherwise pay for his stock because of the Company being allowed by Parliament to pay 12 per cent., and who is perfectly content with his bargain, now be deprived of it?

Witness said he thought broadly, with regard to the Kent Company and all the Companies, that they ought to stand in the same position; and that they ought not to be allowed to go back.

Mr. PEMBER: This is existing legislation, which every Company in the kingdom has got which incorporates the Water-Works Clauses Act of 1847. Why is it to be altered in this particular case, not by a General Act, but in your particular favour?

Witness stated that he thought the time had come when it should be discontinued. The question of back-dividends was much discussed before Sir W. Harcourt's Committee; and he did not think it ought longer to be recognized.

Mr. PEMBER: That is a matter of opinion. Will you give me a reason why, when I have paid solid money in respect of 12 per cent. instead of 10 per cent., I am to be deprived of it?

Witness said he based his opinion upon general law and public policy, which ought to be observed with regard to the Kent Company and all others.

Mr. PEMBER: Why not, then, bring in a General Act which would confiscate everybody's property all round. Is it not a fact that the Legislature, especially regarding the fact that water undertakings in their beginning, and for many years, are notoriously unremunerative, has given power for the owner who chooses to hold on to his shares to recoup himself to a certain extent by back-dividends?

Witness replied that undoubtedly it was so. If the clause was incorporated in the Act, and the whole of the Water-Works Clauses Act was incorporated, that would be one thing; but the Kent Company had separated themselves from a very essential part of the Act.

But for the instruction, the Arbitrator would be able to give something for back-dividends; but he was not bound to do it.

Mr. PEMBER: All we say is, if we are to be bought—which we object to—let us both present our arguments before the Arbitrator. Why is he not to have an open mind about it?

Witness said he could only discuss the point on general propositions. When before the Arbitrator, he thought there should be not only a re-opening of the charge of 7 per cent. on the rateable value, but whether the Water-Works Clauses Act of 1847 should be repealed and turn back *ad infinitum*, having regard to all the circumstances of the case, and also to the discussion before Sir W. Harcourt's Committee on back-dividends. In an ordinary arbitration, the Arbitrator would not be able to treat any single Act as being anything else but binding on him in assessing or valuing under net rental.

Mr. PEMBER: Is it not the fact that the Arbitrator's business, without any instruction whatever, is to hear everything that can be said in favour of enhanced value, and everything that can be said in favour of depreciation of value?

Witness replied that he would hear evidence as to depreciation from facts, but not depreciation arising from any existing public or private competition. The whole question was now before Parliament; and now was the proper time for Parliament to give a direction on this particular matter.

Mr. PEMBER: Did you ever in your life know of Parliament depreciating the value of a man's property before compelling him to sell it?

Witness said that he did not consider that this was doing so. As he was not the Parliamentary Agent, he could not give precedents for it; but if Mr. Pember's proposition was accurate, it would mean that Parliament at no time could make any alteration in the law.

Mr. PEMBER said that he knew that Mr. Harrison had had great experience in assessment cases, conducting Bills in Parliament, and other branches of his profession as a solicitor; and he asked if he could give any instance in the whole 30 years that they had both been in the profession of that having been done.

Witness said that he did not know of any. He had discussed the matter with the Parliamentary Agent, and looked for precedents for what they were doing; and he relied on the precedent of the Gas Companies. Parliament had constantly altered the powers, rights, and obligations of water companies, and also compelled them to remove their intakes. He did not admit that they were promoting a Bill which would destroy public confidence in the equity of arbitration, in the existence of statutory contracts, and in the good faith of Parliament itself. He was aware that trustees were authorized by Parliament to invest in debenture stock of water companies; and though he thought the directions to the Arbitrator were fair and equitable, he admitted that the consequence might be that the market price of the stock would be affected.

Mr. PEMBER: Is not the whole object to prevent the Arbitrator taking into consideration circumstances which, but for those directions he would be entitled, but not bound, to take into consideration?

Witness said it was quite the reverse. It was to enable him to take into consideration matters which, but for the directions, he would not consider.

Mr. PEMBER: It is not "may," but "shall" have regard to them.

Witness remarked that he was not necessarily to act on those rules, but only to have regard to them. He had known of a special direction given to an Arbitrator which he did not feel himself bound to act upon, and cited the Chatham and Dover reference before Lord Cairns.

Mr. PEMBER asked if, in that case, Lord Cairns was not given extraordinary powers to do what he pleased?

Witness replied that this was so. He admitted that none of the provisions of clause 6 were put in in the interest of the Water Companies. The whole question would depend on proof. The proof in regard to one or all of the questions suggested in the directions might fail; and they were not put in for the purpose of depreciation; but merely to give the Arbitrator jurisdiction. He was not willing to strike out any of the directions from the Kent Company's Bill; but the reason for this refusal was not that, without them, they would run the risk of having to pay more for the undertaking.

Mr. FITZGERALD cross-examined the witness, on behalf of the Wandsworth District Board of Works, as to the desirability of the purchase being made by a specially constituted body, consisting of representatives from the various Local Authorities inside and outside London, rather than by the London County Council. Witness said his objection would be that such a body would not be directly representative of the consumers. The interests of the different districts were not identical; and a body of the kind suggested would be unworkable. The number of employees under the County Council was about 6000; and when they took over the tramways, it would add some 2000 more. The present Water Committee of the Council, having finished their inquiries, were perfectly able to manage the water undertaking.

Mr. H. C. RICHARDS was cross-examining the witness for the County Council of Essex, as to the terms of purchase of the East London Water-Works, when

Mr. FREEMAN objected; stating that the matters before the Committee were the Lambeth and Southwark and Vauxhall Bills. Mr. Richards, he said, was asking a number of questions in respect of Essex and the East London Bill, which was not before the Committee, and in respect of which no evidence had been given. Having regard to the *locus* which had been given by the House, he submitted that, though his friend might ask any question affecting his clients on the two Bills named, he was not entitled to cross-examine as if the whole case were before the Committee with regard to the East London Bill. Unless there were some such restriction as this, the amount of time taken would be incalculable, and the Committee would be altogether unworkable.

Mr. RICHARDS said it was a question of principle, which was applied to all the Bills, on which he was cross-examining on behalf of the Essex County Council.

Mr. PEMBER, speaking for the Kent Company, said there was great danger that, if there was anything settled in regard to the first two Bills, it might be made to apply to the others; and it might be too late to raise the points later on.

The CHAIRMAN said the way in which Mr. Pember had stated the proposition was very fair; and he would ask Counsel to observe this point in any questions they might put. He thought the question asked by Mr. Richards, as to whether the County Council would be prepared, if they became the Water Authority, to deal with Essex on a basis corresponding to that upon which they had agreed to deal with Surrey, was permissible.

Witness said they would be willing to do so.

Mr. BATTEN proceeded to cross-examine, on behalf of the District Council of Waltham Holy Cross, as to the manner in which their water rights would be affected by the London County Council taking over the undertakings.

The CHAIRMAN (interposing) said he was informed that the petition of that body had been withdrawn, and that there had been no further notice of appearance.

Mr. BATTEN said he had been instructed to appear, and to cross-examine; and he felt sure there must be some mistake. He would communicate with his clients on the subject.

The CHAIRMAN said he could not allow Mr. Batten to proceed until he had been informed that the appearance was duly entered.

Witness was then cross-examined by Mr. CLARKE WILLIAMS on behalf of the Kent County Council and the Beckenham District Council. The learned Counsel suggested that, after the acquisition, the Kent district would be placed in a much worse position as regards its water supply, inasmuch as they would be deprived of their rights of competition under the Public Health Act; and that, while the London County Council were not bound to supply them at all, they would only sell back to Kent what they did not require for London. In his opinion, inhabitants of the locality from which the water was drawn should be considered before, and not after, the inhabitants of London.

Witness said he did not agree that Kent had a prior right to the water; but that, if the London County Council purchased the undertaking of the Kent Company, it would be subject to all the rights and obligations which the Company themselves had.

Lord R. CECIL cross-examined the witness for the County Council of Middlesex, and elicited from him that, as a general principle, he agreed that the London County Council should not have any jurisdiction in the matter of water supply beyond their limits, if the outside authorities took over the portions of works relating to them. If they retained jurisdiction over the outside localities in respect of water supply, he admitted that the Council might, in the poorer area inside London, charge a lower rate than in the outside area.

In re-examination by Mr. WORSLEY TAYLOR, witness stated that the directions to the Arbitrator were only enabling clauses, so that the Water Companies might not say, when they came before the Arbitrator, that he had no right to go into these questions. As to the means of the Council to satisfy their liability in the case of the purchase being effected, they had introduced a Money Bill this session, so as to provide the funds. Under the Standing Orders, the period of repayment was limited to 60 years, and the Council wanted to make it 100 years; so that it was necessary to introduce the measure as a Public Bill.

The examination of Mr. Harrison being concluded, it was intimated that, in accordance with the wish expressed by the Chairman, Mr Cripps, the Council's Parliamentary Agent would be the next witness.

The Committee then adjourned till the following Friday.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, May 17.

(*Before Mr. Justice* HAWKINS *and a Special Jury.*)

Smith v. South Metropolitan Gas Company.

In this case, Mrs. Smith sued the South Metropolitan Gas Company for damages in respect of an alleged illegal distress and trespass. The defendants pleaded as justification of what they had done a judgment warrant issued by a Police Magistrate.

Mr. DICKENS, Q.C., and Mr. GERMAINE appeared for the plaintiff; Mr. MURPHY, Q.C., and Mr. HORACE AVORY, for the defendants.

Mr. DICKENS, in opening the case, said it was one of great public importance in reference to the powers of gas companies with regard to the supply of gas, and the mode of enforcing payment of arrears due in respect thereof. It appeared to him that, if the defendants were right in the view they took of their powers, anyone in the Court might let his house furnished, go abroad, and give notice to the gas company, and when he came back find his goods had been distrained upon in respect of gas which he had never used. He (the learned Counsel) should submit that, in this particular case, the defendants had acted in a very high-handed manner towards his client. The facts were as follows: Mrs. Smith was a widow lady, who in 1887 went to reside at No. 53, Gorse Road, Wandsworth Common; and she continued to live there till the latter part of 1892, during which time she was supplied by the defendant Company with gas, for which she duly paid. In the latter part of 1892, she arranged to go abroad; and, in September of that year, she entered into an agreement with a Mr. F. E. Wright to let him the house furnished for six months—he to be responsible for the payment of the account for the gas supplied during the tenancy. She wrote to the Company, giving them notice of what she had done; and she asked them to come and take the state of the meter. Accordingly a man was sent by the Company on the 13th of September. Mr. Wright entered into possession, and remained there for the stipulated six months, and paid for the gas consumed in that period. When he left, a caretaker was put into possession of the house; and during the time he was there, a certain quantity of gas was burnt. The Company were informed by letter that of the amount then due for gas—£1 19s.—£1 13s. 6d. was chargeable to Mr. Wright, and the 5s. 6d. would be forwarded by Mrs. Smith, as it had been consumed by the caretaker. The house was then let to a Mr. Portugal, who occupied it for a year. In 1894, the Company took out a Police Court summons against Mrs. Smith and Mr. Portugal for £8 18s. 2d. for arrears of gas-rate. When

the summons was granted, the constable was told that Mrs. Smith was in Rome; and accordingly it was served upon Mrs. Portugal. Mr. Portugal appeared in answer to it, and consented to an order—it being also made against Mrs. Smith, who had never been served with the summons, and had never used the gas. A distress warrant was issued; and a man was put in possession on May 4, 1894.

The learned Counsel having proceeded thus far in his opening statement,

His LORDSHIP remarked that the question appeared to him to be more one of law than for the jury.

Mr. DICKENS agreed that this was so.

Ultimately it was arranged that the case should be withdrawn from the jury; and that, as Mrs. Smith was desirous of returning to Rome, her evidence should be taken on the following day.

Saturday, May 18.

On the resumption of the proceedings this morning,

Mrs. *H. M. Smith* was called, and said the rent of No. 53, Gorse Road, Wandsworth Common, was £36 a year, payable quarterly. She took the house on the 1st of May, 1887, and resided there till the 1st of September, 1892, when she entered into an agreement with Mr. Frederick Edwin Wright to let the house to him furnished at a weekly rental of £1 11s. 3d.—Mr. Wright agreeing to pay for the gas consumed by him during his tenancy. Before she went abroad in 1892, she wrote to the Gas Company, but did not remember if she posted the letter herself. She knew it was posted, because a man came from the Company the next day in answer to it.

Mr. MURPHY said it was part of his case that there was an interview; and therefore the mere posting of the letter became unimportant.

Witness (continuing) said the effect of the letter was that she had let her house furnished, and wished to know if the Company would send a man to take the state of the meter. A man came, and she paid him for the gas consumed up to date. She had not the receipt now. The cupboard in which it was put was locked and sealed when she went away. But when she returned, it had been broken open, and the receipt, among other papers, was gone. She had paid a deposit of 30s. to the Company when she first had a supply of gas. When she paid the man, she asked him for the deposit; but he said he could not return it then, and that she had better claim it when she left the house, and gave up using the gas. He also said that the incoming tenant would have to pay a deposit if he returned her deposit, and that it would be better to leave it open until she returned from abroad. She wrote from Lucerne to the Company, asking them to take the state of the meter, because Mr. Portugal was leaving the house; and she requested them to demand the money due to them. She had received no notice of the Police Court summons being issued against her.

Cross-examined by Mr. MURPHY: She did not say to the man who called that, if there was to be all the trouble of a fresh deposit being paid by her tenant, things had better remain as they were, and she would be responsible for the gas. She continued to pay the taxes of the house during Mr. Portugal's tenancy. She had not written any letter to the Company about the matter. [Several letters were here handed to witness which had been sent to the Company, and which were signed in the name of "C. Smith;" but she denied that they came from her, or that anybody in the house had authority to write in her name while she was away.] She had never received any application for gas-rent while she was abroad.

Re-examined: She had a daughter named Constance Winifred; but the letters shown to her by Mr. Murphy were not written by her daughter, or by anybody whose handwriting she recognized.

The case was here adjourned *sine die*.

HIGH COURT OF JUSTICE, IRELAND—QUEEN'S BENCH DIVISION.

Saturday, May 18.

(*Before Justices* HOLMES *and* GIBSON.)

Alliance and Dublin Consumers' Gas Company v. Corporation of Dublin.

In this case, which was briefly noticed in the JOURNAL last week, the defendants sought to set aside a decision given in an action tried in the Exchequer Division in December last year,* in which the plaintiffs obtained a verdict in their favour for £307 18s. 2d. for work done in connection with certain alterations and repairs of the public lighting plant. The matter had been argued on a motion for a new trial; and judgment was given to-day.

The SOLICITOR-GENERAL, Mr. R. P. CARTON, Q.C., and Mr. P. O'C. WHITE appeared for the Corporation; the Company being represented by Mr. W. KENNY, Q.C., M.P., Mr. J. GORDON, Q.C., and Mr. A. F. BLOOD.

Justice HOLMES said the Company's action depended on the 24th section of the Gas-Works Clauses Act, 1871, which imposed some kind of obligation upon them; and the question was as to what was the value of that obligation. It was contended on the part of the plaintiffs that, while it was their duty to provide gas for the use of the public lamps of the city, they were not bound to lay the service-pipes or make the connections necessary to conduct gas from their chief mains to the public lamps. On the other hand, the Corporation argued that the Company were bound not only to do this, but also to do it gratuitously. He was unable to accept this view. When the Legislature enacted that the undertakers should supply gas to any public lamp within a distance of 50 yards from any of the mains, the natural meaning of this language was that everything that might be required to bring the gas to the lamps must be done by the undertakers. They did not supply gas to the lamp by having it in a main 50 yards away. The only objection that had been advanced against this construction was that it implied that a trading company or co-partnership was obliged to carry out works for the public benefit without any right to compensation. But, so far from finding anything in the enactment that the work was not to be paid for, there was an express declaration to the contrary; for the price to be charged by the undertakers and paid to them for all gas so supplied was to be settled by agreement, and, in case of a difference, by arbitration, regard being had to the circumstances of the case and the price charged to private consumers. The price of gas supplied to the consumer was arrived at by taking into account many items—not the least being the expense of conveying the illuminant to the place; and when the undertakers were called upon to supply gas to public lamps erected by the local authority, they might reasonably require that, in settling the price, regard should be had to the cost of laying the service-pipe and making the necessary connections. No rational distinction could be drawn between a new lamp and an old lamp removed to a new position. He was of opinion that there ought to be no difficulty in ascertaining for what part of the demand the defendants were liable. He understood that no charge had been made for several pipes to new lamps situated within 50 yards of the main. This was right; for he had no doubt that such a charge could not be sustained. He also understood that the Corporation were willing to pay for the service-pipes when the lamps were at a greater distance. This, too, was right; as he was clearly of opinion that this claim could not be successfully resisted. The Corporation were bound to pay the expense of removing a lamp and re-erecting it in a new position; but once there, the Company were bound to connect it with their service-pipes. Then there were "bends" the Corporation ought to pay for, if they were part of the lamps. But the evidence on this point was contradictory; and it would be more convenient to disregard these small items. He thought the defendants were bound to pay for services in connection with meters. The plaintiffs were entitled to the costs of the action; but he thought that under no circumstances ought they to have the costs of the argument. Upon the matters really argued, the defendants were entirely successful, and ought to get the costs; but until they knew the amount of the matters in respect to the meters, they could not very well decide finally.

Justice GIBSON said he could not concur in the view taken by Mr. Justice Andrews (before whom the case was tried) that there was no obligation on the plaintiffs to lay pipes, and that their duty must be considered as limited to the supply of gas through the pipes when laid. He thought that, in order to discharge their statutory duty, the undertakers must, by necessary implication, supply and lay pipes; and they were to be paid for this in the price charged for the gas. The question had been raised as to what public lamps were to receive a supply of gas. He answered: Any public lamp for the time being; and it was immaterial whether they were new or old, shifted or resumed. As to meters, they were in the public lamps belonging to the Corporation; and all expense of shifting or fixing such meters must be borne by the Corporation. With respect to bends, there was a direct conflict of evidence between Messrs. Cotton—one being in the service of the Company and the other of the Corporation—as to whether they were taken over under the Corporation purchase. The controversy was perhaps more a matter of opinion than of fact. In the absence of clear evidence that the bends belonged to the Corporation, and were part of the lamps, he should think the undertakers were bound *primâ facie* to supply and fix them in the same way as the service-pipes; but the item was a small one. The plaintiffs were entitled to retain their verdict—first, as to the amount admitted to be due; secondly, as to work in respect of fixing and shifting meters; and thirdly, the placing or shifting of lamp-posts, if there were any items under that head. With regard to the claim in respect of shifted and resumed lamps, the defendants succeeded. As to the bends, he was inclined to think that the Corporation were also in the right; and the parties might be entitled to a new trial if the matter were worth contesting further. If they could not agree as to the amount for which the verdict was to be entered, it might be that a new trial would be necessary; but he supposed the figures could be agreed on, or ascertained, without any useless expense.

Justice HOLMES announced that Justices O'Brien and Madden (members of the Court), having heard the arguments, concurred in the result.

The SOLICITOR-GENERAL said he was sure the Solicitors on both sides would agree in carrying out the principle of their Lordships' judgment without having a new trial.

Justice HOLMES: There is no doubt your clients must pay the costs of the trial. I have already mentioned that, under no circumstances, ought you to be obliged to pay the costs of these arguments; and I think probably, as far as they are concerned, both parties will bear their own costs. We will keep an open mind on this point until we see the result.

The making of the final order was postponed until next term.

* See JOURNAL, Vol. LXIV., p. 1169.

EDMONTON PETTY SESSIONS.—Thursday, May 16.

(*Before Mr.* J. HOWARD, M.P., *Chairman, and a Bench of Magistrates.*)

Tampering with an Automatic Prepayment Meter.

To-day, Mr. Thomas Collins, of Rangemoor Road, South Tottenham, was summoned by the Tottenham and Edmonton Gas Company for damaging a meter to the extent of 10s., and further with abstracting gas to the value of 4s. 8d.

Mr. J. AVERY represented the Company; Mr. F. ARMITAGE appeared for the defendant.

Mr. AVERY, in opening the case, called the attention of the Bench to the damaged meter, and stated that it was fixed on the defendant's premises on Dec. 6, 1894, and was one of those which worked on the automatic principle. A penny placed in a slot fell upon a projecting part of the mechanism, causing a certain number of cogs to revolve, and allowing a certain quantity of gas to be available for consumption. Instead of a penny being put in to obtain the gas, the corner of the meter had been raised, and some device used to make the cogs revolve. The pennies in the box amounted to only 12s. 3d., while the meter registered gas to the value of 16s. 11d. The defendant had told the officers of the Company that, when the meter would not move, he

hammered it with his fist, and caused the damage shown. But it had not been done in this way. The meter had been prised up, and the mechanism in one corner tampered with; and in doing this the defendant had not only obtained gas, but had injured the meter.

Mr. *A. Handsford*, in the service of Messrs. T. Glover and Co., meter manufacturers, said his opinion was that the meter could not have been in its present condition as the result of a blow from the fist or from a tool; but, by protecting the hand with a piece of rag, to prevent it from being cut, it had been prised up. The nature of the mechanism was such that, for every penny placed in the meter, 22½ cubic feet of gas could be consumed; and, on the exhaustion of that quantity, the index hand went back to zero.

Cross-examined by Mr. ARMITAGE: These meters had been in use some eight years, and were absolutely reliable. The mechanism of the meter in question was correct. It would certainly be injured by a fall; but there was no evidence that it had had one.

Mr. *H. O. Eldridge*, the Company's chief inspector of automatic meters, gave evidence as to the amount of money taken out of the meter, and of the various receipts given.

In cross-examination by Mr. ARMITAGE, witness admitted that this was the fourth meter which had been fixed on defendant's premises, and that defendant complained that he could not get out the gas for the pennies he put in. The second meter was removed on Oct. 3, 1894, and 11d. was found in the box. When the meter was examined at the gas-works, a further sum of 4s. 7d. was found underneath the top of the meter; and a receipt for this was sent. Witness had his suspicion as to how the money got there; but he would not say that the meter was wrong. As a third meter was put in on Oct. 4, and removed on Dec. 6, it might have been complained about. The meters were taken away because they did not register in accordance with the money in them. More gas was used than was paid for. In one case, the defendant might have paid 1d. or 2d. more than he should have done for the gas actually burnt, because it was not possible to register the hundreds. Witness was not aware that, owing to complaints, the defendant had to burn oil. The meter in question was removed from the premises on the 25th of March, and was placed in his (witness's) hands on the 26th in its present condition; and he sealed each side of the damaged opening, to prevent it from being extended.

Re-examined by Mr. AVERY, witness stated that the fourth meter was tested in his presence on the 10th of May, and was found to be absolutely correct.

Mr. *J. Randall*, the Secretary of the Company, gave evidence to the effect that he called upon the defendant on the 8th of May, in company with the chief inspector, and told him about the condition of the meter, and how the top plate had been lifted. Defendant said no one had complained to him about its condition when it was taken away. He further stated that he could not get any gas, so he struck the meter with his fist, and after that the gas came.

James Handley, a service layer and fitter in the employ of the Company, who removed the meter, said it was in its present condition when he took it away; and he called the attention of defendant's wife to it.

Mr. ARMITAGE, replying for the defendant, said there was not a shadow of a case against his client. He had been summoned to answer charges of injuring a certain meter, and abstracting gas to the value of 4s. 8d. The meter was the fourth his client had had. The Company had now fixed a fifth; and on the 21st of March, he wrote complaining that he could get no gas. In answer to that letter, they took the meter away. He contended that no proof had been adduced as to defendant injuring the meter; and with regard to the abstraction of the gas, the evidence given was irrational.

Mr. *A. E. Smith* having been called to give evidence as to defendant's character, and to testify to the fact that he had used oil-lamps.

Mr. AVERY briefly replied for the Company, and contended that, even assuming the defendant's statement to be correct, he had no right or authority to strike the meter. He said he would leave the case to be dealt with upon the evidence that had been given.

The CHAIRMAN said the Bench decided that there must be a conviction upon both summonses; and they inflicted a fine of 10s. and costs, or seven days' imprisonment upon each summons, and a further sum of £1 1s. for the evidence of the witness from Messrs. Glover's. The sentences to run concurrently if the money was not paid—14 days being allowed.

Frimley and Farnborough District Water Company.—The contracts for the works of this Company have been let—that for the pumping plant to Messrs. Carruthers, of Glasgow; that for pipes, to Messrs. James Oakes and Co., of the Alfreton Iron-Works, Derbyshire; and that for a clear water basin at the pumping-station, to hold 287,000 gallons, for a service reservoir on Frith Hill of a capacity of 307,000 gallons, and for the laying of 8 miles of mains, to Mr. Coker, of Rochester.

The Wentwood Water Scheme of the Newport (Mon.) Corporation.—At a meeting of the Water Committee of the Newport Corporation last Wednesday, the principal business was the consideration of a difficulty which has arisen between the Engineer (Mr. C. Kirby) and the Contractor for the new water-works (Mr. Young, of Glasgow). The Contractor had done certain work to an embankment which had failed to satisfy the Engineer—too much stone being used, and too little binding material of earth and clay; and Mr. Kirby has called upon the Contractor to do the work over again. In this attitude, he has received the support of the Committee. The Contractor has refused to comply with the request; and, in accordance with the terms of the contract, he has received notice that the Corporation will proceed to do the work themselves, and deduct the cost from the money to be paid to the Contractor. Mr. Young has, in consequence, served the Corporation with a writ, and will apply to the Courts for an injunction to restrain the Corporation from taking the step proposed, on the ground that the demands of the Engineer are unreasonable. He also asks for the appointment of an arbitrator. The Corporation take their stand on the clauses of the contract, and hold that the requirements of the Engineer must be complied with. The Contractor's application for an injunction will shortly come before a Judge in Chambers.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS AND WATER DEPARTMENTS.

The Annual Reports—The Salaries Question—The Administrative Changes in the Water Department.

At a Special Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Fallows) presiding—the reports of the Gas and Water Committees, which were summarized in our columns last week, were presented.

The report of the Gas Committee having been received,

Alderman POLLACK moved a resolution, authorizing the appropriation of £30,448—the net profit of the department for the year ending March 31 last—to the credit of the improvement rate for 1894. He said the statement of accounts contrasted very favourably with the accounts of the two previous years. In 1892-3, there was a stagnation, and in 1893-4 there was an actual reduction of 2 per cent. in the output of gas. During the last financial year, however, owing principally to the unfavourable weather of the summer and the prolonged frost in the last quarter, the output had increased very considerably, in spite of the drawbacks of bad trade, and the rapid adoption of the gas-saving incandescent burners. The increase of 225 million cubic feet, or 5·2 per cent., was, with the exception of the increase of 235 millions in 1891-2 the largest recorded since the transfer of the works. The increase varied in the different quarters from 1 per cent. to 9¾ per cent.—the latter being during the quarter of the prolonged frost. To produce the additional output 26,000 tons of coal were consumed beyond the previous year. Yet the expenditure on coal—altogether 482,000 tons—was £11,700 less. This was not due to any tangible reduction in the price of coal, but to the additional cost entailed upon the Committee in the previous year by the great coal strike, which he estimated at the time meant a loss of £15,000 to £20,000. Referring to the hampering conditions of the railway rates, Alderman Pollack pointed out that the Committee were now paying indirectly in railway rates for carriage of coal and coke £20,000 more than seven or eight years ago on the same tonnage. The additional revenue on gas had been £35,000; but from £15,000 to £16,000 was due to the higher price charged during part of the year. The total receipts for gas (£490,847) were by far the largest recorded; and the amount was not likely to be reached again for several years to come—the average increase of consumption over the last three years being a very little above 1¼ per cent. It was necessary for the department to be prepared for every contingency, and to increase still further their plant. The last frost did not try their productive capacity to the utmost, because it occurred when the days had already lengthened. Had it been in the busy season, just before Christmas, the case would have been different. The Committee were earnestly considering the least expensive means of supplementing the present plant in case of emergency. Cheaper coal, larger consumption of gas, labour-saving machinery, were all important factors which made up the prosperous year; but they would hardly have made up the balance unless accompanied by the satisfactory revenue from residuals, which produced £140,475, or £5000 more than in the previous year. As to the item of rates and taxes, they had been growing year after year, until they now reached £23,417, or £2000 in excess of 1893-4; and as compared with £14,600 in 1892. Last year the Committee were able not only to make the usual provision for renewal of plant, but to write down some of the capital expenditure which it was necessary to incur, but for which there were no tangible assets. It was thought desirable by the Committee to appropriate £24,737 of the profits as an addition to the sinking fund, beyond the amount required by Act of Parliament; but after making this allowance, there was the actual balance of £30,448. The sinking fund now stood at £461,353. The total contribution to the improvement rate since the transfer of the gas undertaking had been £507,724, exclusive of the annual interest of £4000 on the reserve fund, and of the reduction in the price of public lighting. The direct and indirect contribution to the improvement rate during the past year was £46,192; while there was an additional £3551 in the reduction of public lighting for the outlying districts. These results he thought would be satisfactory alike to the Council and to the ratepayers.

Alderman BAKER seconded the motion.

Mr. PRICE desired to know if the increase in rates and taxes was due to extension of buildings and machinery or previous under-assessment.

Mr. HOWARD LANE regarded the contribution of £30,448 to the rates as nothing like sufficient, considering the increase in revenue derived from the advanced price of gas, the exceptional season, and the saving on coal. In his opinion, the amount should have been at least £50,000. The Committee had taken £50,000 or £60,000 more from the ratepayers, and only given them £5000 more than the previous year. He further considered the amount expended in repairs and renewals—£87,450—perfectly appalling, when in the previous year it was £64,000, and the year before that £44,000.

Alderman POLLACK explained that the Overseers had considerably raised the assessments during the last two or three years; and the income-tax had also increased. In answer to Mr. Lane, he said that the magnitude of the item to which he objected was accounted for by the fact that the Committee had taken advantage of a prosperous year to write down the capital account, which was now less than it had ever been. When they took over the gas undertaking, the account was £2,000,931, with a production of 2327 million feet; and since then they had about doubled the productive capacity, had an annual output of 4214 million feet, and had only increased the capital account by 10 per cent., to £2,191,777, besides having created a sinking fund of £470,000 and a reserve of £100,000. There were, he thought, few businesses which could show similar good results in nineteen years.

The motion was agreed to.

Alderman POLLACK next moved that the salary of Mr. Henry Hack, the Engineer of the Saltley gas-works, be increased from £1050 to £1200 per annum. Explaining the circumstances under which the proposa was made, he said that, when the transfer of the works took

place, Mr. Hack had recently succeeded Mr. Young, whose salary was £1300. When the transfer was effected, Mr. Hack was requested by Mr. Chamberlain to remain in his then position at the salary of £600, with rent, gas, and coal free, and income-tax paid by the Committee; and the understanding was that the officers would be no worse off than under the old *régime*. So satisfied were the Committee with the results of his work, that they voluntarily increased his salary to £900 in 1882. At the end of 1883, it became necessary for him to give up his house at the works; and he was allowed an additional £50 in lieu of the privileges he had enjoyed. This really meant a reduction of £60; the idea being to equalize his salary with Mr. Hunt's. Mr. Hunt had an increase in 1888 to £1200; and in the following year, Mr. Hack's salary was raised to £1050, at which it now stood. Taking into consideration the coal, gas, rent, and income-tax, which he now had to pay, Mr. Hack was really receiving only about £40 more than in 1882. Alderman Pollack referred to the great increase during that time in the productive capacity of the works, and that something like £200,000 had been spent on additional works designed and carried out entirely by Mr. Hack, without any charge for professional assistance. The increase, he felt sure, would not only be an act of justice to Mr. Hack, but to the interests of the department and of the town at large.

Mr. Beale seconded the motion.

Mr. Coombs strongly protested against the increase. It was a most inopportune time, he said, when trade was bad, and the price of gas had actually been increased.

Several speakers followed both for and against the resolution.

Alderman Pollack, replying to the discussion, said that the works superintended by Mr. Hack produced considerably more gas than those under the charge of Mr. Hunt. Those who believed their Engineers were more highly paid than in other towns were mistaken. At Leicester, where 100,000 tons of coal were carbonized, as compared with 480,000 tons in Birmingham, the salary of the Chief Engineer (Mr. A. Colson) was £1250 per annum. That was one instance, and others might be given of salaries ranging from £2500 downwards. The Council entrusted the Gas Committee with the disposal of hundreds of thousands of pounds; and was it likely, therefore, they would come forward with a recommendation that was not absolutely in the best interests of the city? The recommendation that Mr. Hack's salary be increased was made in the interests of the Gas Department and the city, and, moreover, as an act of justice. Since Mr. Hack last received an increase, the Committee had raised the wages of their workmen, and had made them more comfortable, at a cost of £35,000 a year. The Council agreed to that; and surely they might have confidence in the Committee now.

Alderman Dr. Barratt asked if it was to be understood there would be no pension at some future time if the salary was increased.

Alderman Pollack replied that the Gas Committee had a superannuation fund, to which the salaried officers subscribed.

The resolution was lost by 39 votes to 22.

The salary of the Assistant Engineer of the Saltley works (Mr. Morrison) was increased from £300 to £350 per annum; but a proposal to raise the salary of the Superintendent of the Fittings Department (Mr. Barrett) from £350 to £400 was deferred, until the Committee have furnished the Council with a profit and loss account of the department from 1891 to the commencement of the present year. The profit on the Fittings Department last year amounted to £1838, as compared with £1172 in the preceding year.

The administrative re-organization scheme of the Water Committee (which was outlined in the summary of their report in the Journal last week) was next discussed at great length.

Alderman Lawley Parker first moved that Mr. Henry Davey, of Westminster, be appointed Consulting Engineer to the Water Department, at a salary of £200 per annum. He said the resolution was only part of the scheme to provide for the management and engineering of the department until the Elan supply came into operation. The scheme as submitted by Mr. Mansergh to the Committee was rather a novel one; and it had been very carefully considered. The scheme divided itself into four heads—first, the appointment of Mr. Davey as head of the engineering department; second, the appointment of the present Assistant Engineers (Mr. Raynes and Mr. W. Gray) to have charge of the distribution and the structural charge of the mains, the reservoirs, and the filters; third, the appointment of the three present station engineers with the independent charge of their respective stations; and, fourth, that in the hands of the Secretary (Mr. E. A. Lees) should be placed the general superintendence of the department; he being, in fact, the chief local adviser for the time being.

Mr. Barber seconded the resolution.

An amendment was proposed; but, in the end, the resolution was carried by a substantial majority.

Alderman Parker then proposed that the salary of the Secretary to the Water Department be increased from £600 to £800 per annum. He said the services Mr. Lees had rendered were very exceptional; and the circumstances under which they had been rendered were also very exceptional. He had remodelled and reformed the whole of the office arrangements, and also entirely organized the working staff and the system of book-keeping in connection with the new scheme both at the Elan Valley and at the Broad Street offices. The details connected with the office had enormously increased, as would be gathered from the fact that the number of clerks had increased from 52 to 109 since his appointment. Moreover, the salary he was receiving was less by £100 than that paid to his predecessor, when the duties were far less onerous, and, judged in relation to the water-rental, was below that paid in towns of about the same size as Birmingham.

Mr. Stembridge seconded the proposition, which was lost; 26 votes being recorded in favour of it, and 28 against.

The salary of Mr. Raynes was afterwards advanced from £200 to £300 per annum, and that of Mr. Gray from £180 to £250.

The consideration of the annual report of the Water Committee was adjourned.

A New Reservoir at Flint.—A new reservoir has lately been completed for the Flint Gas and Water Company. The capacity is some 300,000 gallons; and the cost amounts to about £1200.

THE LONDON COUNTY COUNCIL AND THE TESTING OF GAS.

Suggested Legalization of the Dibdin Ten-Candle Pentane Burner.

The Public Control Committee of the London County Council have presented the following report on the proposed alteration of the standard to be used for testing gas in the Metropolis, as suggested by the Board of Trade Committee on Photometric Standards:—

It is with great satisfaction that we are able to inform the Council that the Committee appointed by the Board of Trade in 1891 to recommend a standard for testing the illuminating power of gas, in substitution of the present candle standard, have now presented their report. The Acts of the principal London Gas Companies require that the illuminating power of the gas shall, when consumed at the rate of 5 cubic feet per hour by means of a standard Argand gas-burner, be equal in intensity to the light given by 16 sperm candles of six to the pound, each burning at the rate of 120 grains per hour. The unreliability of the candle standard has long been admitted—a Committee appointed by the Board of Trade in 1879 having reported in condemnation of the standard; and subsequent inquiries by the Council's officers, by a Standard of Light Committee appointed by The Gas Institute, as well as the experience of the Metropolitan Gas Referees and of the Gas Companies, have furnished additional proof of the necessity for a more exact standard. Reports which we have received from the Council's Chemist furnish strong grounds for the belief that, since the standard was prescribed, variations in the manufacture of the candles have taken place, which have resulted in a considerable reduction of illuminating power, while still keeping within the terms of the statutes.

The late Metropolitan Board of Works was fully alive to the importance to consumers of a reliable standard being prescribed; and exhaustive examinations were made by the Chemist, assisted by experienced photometrists in the employ of the Board as Gas Examiners, of the merits of various alternative standards proposed. The Board of Trade has been repeatedly approached, both by the Metropolitan Board of Works and the Council, with a view to an amendment of the law being obtained; and conferences have been held with representatives of the Gas Companies. The correspondence and conferences led, in 1891, to the South Metropolitan Gas Company undertaking to defray the expenses of a scientific Committee to consider what standard of light should be recommended for adoption. The Board of Trade thereupon appointed a Committee, including representatives of the London Gas Companies, the City Corporation, and the Gas Referees, as well as two independent scientific men, on which the Council was represented by its Chemist (Mr. W. J. Dibdin) and Dr. E. Frankland, F.R.S.

This representative Committee have come to a unanimous decision as to the standard to be recommended. They find that the flame of the parliamentary sperm candle does not furnish a satisfactory standard; that it is desirable that the standard should be produced by the process of combustion, and be of the nature of a flame; that Mr. A. Vernon Harcourt's 1-candle pentane standard, which was favourably reported upon by the Board of Trade Committee of 1879, constitutes a very exact standard, capable of being reproduced without variation of illuminative value, but that for practical use in gas-testing the flame of the 10-candle pentane Argand, proposed by Mr. Dibdin in 1886, is the best available standard. This flame is produced by burning a mixture of air and pentane vapour from a suitable Argand burner provided with an opaque screen, by which the light from the upper portion of the flame is cut off. The screen being set at a definite height, the luminosity of the exposed portion of the flame remains constant under considerable variations, whether in the total height of the flame or in the proportion of pentane vapour to air in the mixture burnt. The Committee accordingly recommend this appliance for adoption as the prescribed standard for official use in testing the illuminating power of the gas supplied by the London Gas Companies. They further recommend, with a view to making provision for possible future improvements and requirements, that the Gas Referees be authorized to approve and certify, with the consent of the Board of Trade and the Gas Companies, any other flame based upon the above 10-candle standard for use in gas-testing. A recommendation is also made with regard to the method of recording the illuminating power of gas and rate of consumption to be prescribed for testing purposes.

We have passed a vote of thanks to the Chemist for his successful labour and research in connection with this question, and for his services on the Standards of Light Committee, which are quite outside the ordinary scope of his duties. We have also passed a vote of thanks to Dr. Frankland for acting as one of the Council's representatives on the Committee. We are further of opinion that no time should be lost in giving effect to the Committee's recommendations, and in putting an end to a condition of things which has for so many years stood condemned, and a remedy for which is suggested with such general concurrence of expert opinion. We accordingly recommend—"That a letter be addressed to the Board of Trade, again expressing the Council's opinion of the urgent need for the provision of a more trustworthy standard of light for gas-testing than the present candle standard, and asking what action the Board propose to take to give effect to the recommendations of the Standards of Light Committee; and whether, having regard to the unanimity and representative character of the Committee, a short Bill for the purpose will be promoted during the present session of Parliament."

WEST BROMWICH GAS SUPPLY.

The Annual Report.

The report and statement of accounts of the West Bromwich gas undertaking for the year ending March 31, 1895, have lately been issued by the Secretary (Mr. T. Hudson); and some figures as to the working of the undertaking were given in the Journal for the 7th inst. The report states that the borrowing powers were increased during the year by the raising of Corporation stock amounting to £2782 for proposed stoking machinery. If this was not adopted, the money will be paid into the fund for the extinction of debt. The loan

capital has also undergone some modification, by reason of the mortgage of £80,000 being repaid, and stock substituted. The mortgage debt has been reduced to £9500. The total amount of debt extinguished since the commencement of the undertaking is £17,094; while further provision for extinguishment has been made to the extent of £5691. The amount expended on capital account in the past year was £1481, less £173 spent in the construction and fitting up of coal-testing apparatus in excess of that authorized by the Local Government Board. This excess has been provided for out of the surplus profits. The total capital expenditure is £197,564, or equal to £9 6s. per ton of coal carbonized, and £903 2s. 8d. per million cubic feet of gas made. The income from the sale of gas showed a satisfactory increase last year; being £767 more than in the previous twelve months. Some of this was due to the extremely cold and dark weather prevailing during the months of January and February; but a certain proportion was attributable to an augmentation in the consumption in factories and workshops generally. The largest increase was in the class of consumers supplied at 2s. 4d. per 1000 cubic feet, though among those charged 2s. 3d. there was an advance. The number of houses in the borough in November, 1894, was 12,378; and of these only 4929 were supplied with gas. The total number of consumers at the end of the financial year was 5212, as compared with 5205 at the close of the previous twelve months; and the quantity of gas used by them was 189,950,200 cubic feet, or at the rate of 36,444 cubic feet per consumer. The number of meters fixed was increased by 121. The yield of residual products per ton of coal carbonized was in excess of the previous year; but the aggregate income therefrom was £9552, as compared with £9688, or a decrease of £136. The total income from all sources was £37,124, against £36,571 in 1893-4; while the total expenditure was £26,622, against £28,720, or a decrease of £2098. The total manufacturing charges amounted to £19,513, as compared with £21,577—a decrease of £2064, or equal to 1s. 11d. per ton of coal carbonized. The coal for gas making cost £1729 less than in the preceding year, or a decrease at the rate of 1s. 9¾d. per ton. Wages showed a diminution of £180. The expenditure for repairs, maintenance, and renewal of works and plant was £1835, or £35 less than before. The cost of erecting the second bench of retorts on the regenerator system was £2573; and to meet this extra outlay, £783 was applied from the depreciation fund—thus leaving £1790 to be provided from other sources. The bulk of coal and cannel carbonized was 21,239 tons—an increase of 294 tons; and the quantity of gas made was 218,754,000 cubic feet, or an average of 10,299 cubic feet per ton. This was better than in the three previous years. The net cost of coal was £2609. The total expense of distributing gas throughout the borough (including repairs and maintenance) was £1515, as compared with £1616 in the previous year; being a decrease of about £100. The quantity of gas sold per mile, including the public lighting, was 4,818,550 cubic feet. The total number of public lamps was 935. The gross profit was £10,501, or 5·69 per cent. on the capital employed, compared with £7850 in 1893-4—an increase of £2651. The accumulated profits in hand at present amount to £9983; and they are considered sufficient for the purposes of working capital. The balance of the sinking fund is £2859; that of the depreciation fund being exhausted. The undivided profits have been reduced to £8631. The amount charged for redemption and the extinction of debt on the undertaking is £3154. The interest charges amounted last year to £5909. After making provision for payment of these, there was at the close of the year a surplus of £1351, compared with a deficiency of £265 in 1893-4.

NEWBURY CORPORATION GAS SUPPLY.

The Past Year's Working.

At the Meeting of the Newbury Corporation last Tuesday, the report of the Gas Committee, on the working of the gas undertaking in the year ending March 31, was presented. The Committee expressed the opinion that highly satisfactory results had been obtained since the alterations had been carried out at the gas-works. Mr. Lucas, in moving the adoption of the report, remarked that the Committee had been subjected to a good deal of unfair criticism, as he had more than once observed; but he thought the statement now submitted was a good answer to the critics. There had been spent on capital account, in the purchase of old works, in erecting new ones, and in making extensions and additions, £33,745; and there was a balance to the credit of capital account of £355—making a total of £34,100. This had been provided as follows: First bond loan, £25,000; second loan, £3000; taken from profits, £6100. Out of the total bond debt of £28,000, £2600 had been paid off out of the sinking fund provided by the profits; leaving £25,400 due on bonds. This would be reduced to £25,000 on the 24th of June by the payment of another bond of £400; still leaving more than £500 to the credit of the sinking fund. So that the total indebtedness in respect of the £33,745 spent would be only £25,000. He did not think these figures were generally appreciated. If they were, nine-tenths of the criticism to which the Committee had been subjected would not have been uttered. Turning to the revenue account, which was, in his judgment, eminently satisfactory, private consumers had been larger purchasers; and there had been a satisfactory increase in sales of gas. The profit had been £2036, compared with £1385 in 1893-4—an increase of £651. The gross profits were slightly in excess of 8 per cent. on the present indebtedness. After paying the sinking fund instalment, the interest on bonds, and all other charges, and bringing forward the balance of £69 from last year, there remained a sum of £723, which would, under ordinary circumstances, have been available for a reduction in the price of gas, or for applying in relief of the rates. But as they had not yet paid off the whole of the £7000 agreed to be written off for depreciation, they had devoted £700 towards this object. The amount received for residuals was fairly satisfactory. He only wished to allude to one item—sulphate of ammonia. The price for this varied very much. They had made more, but had obtained less money. His principal object for mentioning sulphate of ammonia was again to justify the Manager (Mr. R. M. Couper) and confound his critics. In four years they had made from treating their liquor a profit of £430, or within £86 of the total cost of the sulphate house and plant. Turning to the manufacturing results, he thought that again there was ample reason to congratulate themselves on the improvements consequent on the new plant and additions to works. In the year ending March, 1894, they carbonized 2806 tons of coal; in the past year, 2793 tons—or 13 tons less; and yet they made 2,414,000 feet more gas—the quantity being 30,024,000 cubic feet, as against 27,610,000 cubic feet in the previous twelve months. The make of gas per ton had been 10,750 cubic feet, as compared with 9840 feet in the previous year. The sales of gas per ton of coal had been 9563 cubic feet, as against 8971 cubic feet per ton. Unfortunately, the leakage account had gone up from 6·63 to 9·17 per cent. The only possible way to account for the increase was the loss arising from fractures of mains arising from the drainage operations. A severe test of the improvement effected during Mr. Couper's managership was to be found in the fact that in 1881 the total working expenses for every 1000 feet of gas sold were 2s. 7½d., whereas now they were only 1s. 5½d. This was the real test of management, and this item had been gradually going down. Mr. Smith seconded the motion. Alderman Jackson said he still maintained that the works had never paid under the management of Mr. Lucas and Mr. Couper, though they did before. Mr. Long thought this was hardly a fair thing to say, as the borough had reaped the benefit of the reduced price of gas. Mr. Withers considered the report was certainly a more satisfactory one than they had had before; and it was only fair to congratulate the Chairman of the Gas Committee upon it. Mr. Lucas, in reply, said as to Alderman Jackson's parting shot, that the gas undertaking had been no good to the town, he had figures to show that, under the present management, since 1882, the consumers had benefited to a large extent. There was, first, the reduction of 1s. per 1000 cubic feet from 1884 to the present time, which had meant a saving of £10,689; secondly, by the discount system from 1888, they had benefited to the extent of £2002, or a total of £12,691. The works had also been improved out of profits to the extent of £6100; making a grand total of £18,791. The report was adopted.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

As a result of the operations of this Company during the year ending Dec. 31 last, after making due provision for bad and doubtful debts, the Directors are in a position to recommend the payment of a dividend at the rate of 4 per cent. per annum. This improvement of dividend, as compared with that of the previous year, is due to the increase in the consumption of gas, and to the low freights on supplies. The continual fluctuations in the value of the currency are a disturbing element in the business of the Company; and the Directors state that they continue to use every effort to mitigate this evil by reducing the cost of manufacture. To this end they have adopted Young's process of carbonizing oil in part substitution for cannel; the exclusive right of using this patent in the Argentine Republic having been secured on terms very favourable to the Company. The contract with the Municipality for public lighting, which has been carried out by the Company for the last twenty years, terminated on the 1st inst. Negotiations with the authorities are now in progress with the view to a new contract. Although the business of the South Barracas Gas and Coke Company (worked under lease by this Company) continues to show steady improvement, the Directors have considered it expedient to place to a suspense account a sum of £1200 against any loss that might eventually occur on the termination of the lease. The quantity of gas sold shows an increase of 8·83 per cent. over the previous year; and there are 5·21 per cent. more meters connected. The profit for the year is £40,436, adding to which the balance of £2979 from 1893, makes a total of £43,415. After the payment of debenture interest (£12,000) and amounts reserved for renewal fund and suspense account, £20,133, there remains to be dealt with £23,282. The Directors, as already mentioned, recommend that the dividend for the year be at the rate of 4 per cent. (free of income-tax), 1 per cent. of which has already been distributed. The balance of £3282 is to be carried forward.

Scarborough Corporation Water Department.—The annual report of the Water Engineer of the Scarborough Town Council states that the total receipts of his department for the past financial year (including £257 brought forward) amounted to £13,099; and the expenditure, to £13,415—leaving a deficit of £316. The total quantity of water pumped from the different stations was 388,937,017 gallons.

Lambeth Water Company.—The report of the Directors of this Company for the six months ended March 31 last states that, during the half year, 842 houses and other supplies of water, estimated to yield an annual rental of £2201, were connected with the Company's works, as compared with 1007 houses, &c., producing a rental of £2567, laid on during the six months ended March 31, 1894. The capital account shows an expenditure during the half year of £4638; making, since the passing of the Metropolis Water Act, 1871, a total outlay on new works, &c., of £883,962. An issue of £20,000 of 4 per cent. debenture stock was offered by tender in February, payable on March 30. It was allotted at an average price of £136 18s. 10d. per £100, realizing £7389 premium, less expenses £90 16s. 10d. The revenue account exhibits an increase of £1007 in water-rents, &c., and of £14,758 in expenditure, as compared with the corresponding period of 1893-4. The additional expenditure is mainly accounted for by the outlay caused by the late phenomenal frost. This outlay amounted to £13,427 up to the end of March; and a further expenditure has been incurred during the current half year. The surplus transferred from revenue account to dividend and interest account is £55,399. There is to the credit of the latter account, after payment of interest on debenture stock, an available balance of £51,501. The Directors recommend the distribution of a dividend at the rate of 7½ per cent. per annum on all the share capital of the Company. This will necessitate the withdrawal of £3000 from the contingency fund. The dividend will amount to £54,375; and consequently a balance of £126 will remain to be carried forward.

ELECTRIC LIGHTING NOTES.

The London County Council, at their meeting on the 7th inst., agreed to certain recommendations of the Finance Committee as follows: "(1) That, subject to the Council hereafter giving its written consent under seal to the borrowing, and subject to all necessary consents and evidence being furnished to the satisfaction of the Solicitor of the Council, the application of the Vestry of St. Pancras for a further loan of £14,600 towards defraying the cost of an electric light installation in that parish be granted to the extent of £14,300, on condition that the loan be taken up at once, interest being charged thereon at the rate of £3 5s. per cent. per annum, calculated quarterly, and with the principal being repaid by such equal half-yearly payments of principal and interest combined as will repay the amount borrowed within a period of 42 years; that it be referred to the Solicitor to take the necessary measures for completing the loan, and that the amount be advanced out of the Consolidated Loans Fund. (2) That it be notified to the Vestry of St. Pancras that, as they have elected to spread the whole of the initial cost of the electric light installation over 42 years, the Council will decline to sanction the raising of any loan to replace any of the works, plant, and machinery during the currency of the loan, and will expect the Vestry to provide for all such renewals as may be required during that period out of a sinking fund to be established, or out of a maintenance account.' At a meeting of the St. Pancras Vestry last Wednesday week, the loan question came up; and Mr. Clements proposed that, instead of borrowing from the Council, the matter be referred to the Finance Committee in order to arrange a public issue of bonds at 3 per cent. This scheme was supported by several members; but Mr. Wetenhall pointed out that it would be decidedly impolitic on this occasion, not to obtain the loan from the Council, after entering into negotiations with them for it, and having their consent. This advice was adopted; but it was generally understood that, when future loans are required, the lines suggested by Mr. Clements shall be carefully considered.

The Special Lighting Committee of the Liverpool City Council had a meeting on Monday, the 13th inst, when the report of Sir F. Bramwell, who had been engaged to examine the plant and other property of the Electric Supply Company, Limited, on behalf of the Corporation, was presented. It described the condition of the whole of the machinery and appliances. The conclusion to which Sir Frederick arrived was that everything was most satisfactory, and that the purchase would place the Corporation in possession of a valuable property. The report of Mr. Barrow (the City Auditor) was equally satisfactory. Mr. Harcourt E. Clare (the Deputy Town Clerk) submitted the draft of the agreement with the Company, which was considered. Its adoption is, of course, subject to the approval of the Company. The total amount of the purchase-money is £400,000. The Committee decided to retain the services of Mr. Holmes, the Managing Engineer of the Company.

Mr. W. H. Preece, the Consulting Engineer on electrical matters to the Corporation of Great Yarmouth, has advised that body to extend the electric lighting plant and system; and he has succeeded in getting them to believe that it is the proper thing to do. The number of lights in the streets he recommends should be doubled; but the Borough Surveyor takes a contrary view, on the ground that the cost of lighting 52 arc lamps now in use is £700, while the gas displaced would only cost between £380 and £400. Mr. Preece anticipates that, in two or three years, the Corporation would be supplying 14,000 lamps, instead of the 4000 now in use; and as Mr. Preece "anticipates" this, the Corporation evidently have no doubt that it will come to pass. The existing plant he says is inadequate, and extensions are necessary; and he recommends the Council to provide plant sufficient to supply 9000 additional lamps at one time—his detailed estimate for this being £15,500. The Council at their last meeting were recommended by the Electric Lighting Committee to apply at once for sanction to a loan of £15,000 to carry out the proposed works. In moving the adoption of the recommendation, Mr. Martin made some very hopeful remarks. He observed that there was great promise that it would "eventually" become a successful venture for the Corporation. Street lighting, of course, was very expensive; and this could not be at present extended. Private customers yielded profit, and *when* this showed itself would be the opportunity for extending the street lighting. It was pointed out by Mr. Williment that, when the scheme was launched two years ago, figures were ingeniously put before the Corporation to show that an installation of 4500 lamps could be made to pay. They had a plant of this capacity; and now Mr. Preece told them it would only supply 2250 lamps, or half the number, and that, in order to meet their requirements, they would have to put down further plant. He did not like to be misled; and he maintained Mr. Preece did mislead them when he said the 4500-lamp installation would pay a profit. At present there was a serious loss in working expenses alone; for the Surveyor had made no calculation whatever for depreciation or capital charges and interest. When they came to take these items into consideration, they would have a very nice little bill for the ratepayers to pay. Mr. Stanley remarked that he could not blame Mr. Preece for recommending further expenditure, for he was certainly getting more benefit from it than the ratepayers. As already intimated, the recommendation was adopted. It is interesting to note that during April there was a loss on the working of £28, and only 75 customers were connected.

An incident of a very serious character occurred at the Powick electric lighting works of the Worcester Corporation last Wednesday night. Two of the dynamos failed through the burning out of some of the armature coils; and resulted in the lights being extinguished, though fortunately for only a brief interval. It is stated that the City Electrical Engineer (Mr. Ruthven Murray) intends to propose that very radical alterations shall be made; so that the regularity of the supply shall not be interfered with.

Last Thursday, the Electric Lighting Committee of the Hampstead Vestry brought up the following three recommendations: (1) That a Chief Assistant Electrical Engineer be appointed; (2) that his salary be £200 per annum; and (3) that Mr. E. Sayer, at present one of the Assistant Engineers at the central station, be appointed to such office. The Vestry recently appointed a Chief Electrical Engineer, who, however, has not yet entered upon his duties. Many members, therefore, maintained that it would not be courteous or right to appoint his principal assistant in his absence, and without his acquiescence. This matter was pressed throughout a long and noisy discussion; and an amendment by Mr. G. Eustace Smith, that a temporary assistant be appointed at an increased salary (the gentleman proposed having only received £2 weekly hitherto), was defeated. More wrangling ensued. A similar amendment was proposed by Mr. Richardson; and it met the same fate. Mr. Hall then moved that the salary should be £150, rising to £200; but this also was lost. When the third recommendation was considered, the greatest excitement prevailed. In the end, the three recommendations were approved; a further amendment that the claims of the two other assistants be considered being defeated. A curious and inexplicable incident marked a request by Mr. Johnson for certain particulars as to the cost of mileage of cables, &c., which have been repeatedly promised by the Chairman. In reply to a member, Mr. Johnson admitted that he personally knew the facts; but he wanted them promulgated in the open Vestry, for the information of the ratepayers. Mr. Hackworth here moved the closure, which was carried—a proceeding which Mr. Johnson described as "a very unfair way of meeting awkward questions."

THE ANNUAL REPORT OF THE CHIEF INSPECTOR UNDER THE ALKALI ACT.

The Thirty-first Annual Report of the Chief Inspector under the Alkali, &c., Works Regulation Act, 1881 (Mr. A. E. Fletcher), embracing his proceedings during the past year, was issued last week as a parliamentary paper. As on previous occasions, we extract those portions which have the greatest interest for our readers.

Mr. Fletcher begins by stating that, though a considerable increase of work has been caused by the operation of the Amendment Act of 1892, there have been no additions to the working staff; nor have there been any changes among the Inspectors or Sub-Inspectors. The number of works now registered in England, Ireland, and Wales, under the Act, is 1056, of which 102 only are alkali works proper, while 954 are included in the schedules of other works which have more recently come under its provisions. These numbers show an increase of one alkali works and of nine others since 1893. There are also 126 works registered in Scotland; bringing up the total number to 1182. Concerning these works, a separate report is presented to the Secretary for Scotland. The amount of work undertaken by the Inspectors under the Act is best shown by the separate manufacturing processes under inspection. Several processes are often carried on at one factory, and in that case are included under one registration; but each receives special examination. The number of such processes in England, Ireland, and Wales is 1520, which is an increase of 25 upon that of 1893. In Scotland, however, it remains unaltered. The number of visits is irregular, and depends on the process carried on, and the general condition of the work. Usually, a visit is made the occasion not only of a general inspection, but often a definite test or chemical examination of the gases passing into the air. The number of visits made last year was 4992; the number of tests being 5032. In Scotland, 523 visits were paid; and 322 examinations of gases were carried out.

There were seven prosecutions under the Act last year—two being in connection with gas undertakings in which "obstruction" was offered to an Inspector, in contravention of section 17 of the Act. A penalty of £10 was inflicted in each case. Happily, this is the first time a charge of the kind has been brought; and it is to be hoped it will be the last. It may be well to quote the report on this matter: "It is provided in section 17 that all necessary facilities shall be afforded for the due entry into, and examination of, registered works, and of the apparatus used for carrying on the processes of manufacture. A penalty is attached to the offence of obstructing an Inspector in the execution of his duty. In both cases here referred to, the Inspector was informed that the sulphuretted hydrogen generated in the manufacture of sulphate of ammonia was brought, as is usual in works of this kind, to an oxide of iron purifier. Thereby coming in contact with the oxide of iron, the sulphuretted hydrogen is decomposed—the hydrogen being oxidized, and the sulphur retained as in a filter; the residual inert gas passing away into the atmosphere purified. As the Inspector was distinctly informed that all the sulphuretted hydrogen was thus dealt with, he from time to time examined the purifier; and finding that no sulphuretted hydrogen escaped from it, and that it seemed to be in perfect condition, he was satisfied, until some trifling circumstance raised a suspicion that a secret road had been provided for the noxious gas in question, and that in reality it was conveyed to the chimney, and thus thrown into the air. After some inquiry, this, in both places, was found to be the case; the motive on the part of the manager being to save the expense which attends the periodical renewal of the oxide of iron in the purifier. It was doubtless contended that the sulphuretted hydrogen was burnt in the chimney, and so rendered harmless; but of that the Inspector was ignorant, not having examined it, as he had been assured that the gas was led in another direction. The important point was that there was a secret pipe buried in the ground, the presence of which was denied; and thus the Inspector was 'obstructed' from examining the effluent gases, as was his duty." On these facts being represented to the Local Government Board, sanction was granted to the institution of a prosecution against the two offending companies or their managers. As these prosecution are conducted in the County Courts, application for the penalty is first made as for a debt. In both these cases the amount of the penalty was immediately paid, so as to stay all proceedings and avoid publicity. Mr. Fletcher remarks on this matter: "It is much to be regretted that, in these two cases, there should have been introduced a spirit so much at variance with the open-handed confidence that has generally been maintained between the Inspectors and the manufacturers."

Passing on to deal with alkali works, Mr. Fletcher states that the Leblanc soda works still hold their own against those of the ammonia

soda process, by virtue of the bleaching powder which they alone can produce. Efforts are still put forth to utilize for it the chlorine of the salt decomposed in the ammonia-soda process; but as yet they have not been largely successful. All departments of manufacture suffered greatly during the coal strike of 1893; and from this the alkali trade did not escape. An attempt is now being made to supersede both the Leblanc and the ammonia-soda process by the use of electricity. Mr. Fletcher says that where electricity can be produced cheaply by the use of water power, it will doubtless be a more formidable competitor with the chemical processes; but looking at the many points of leakage of energy where electricity is generated by a steam-engine, it would appear that the present methods are not seriously threatened. Should the time ever arrive when coal can be used directly to form, as zinc now does, the positive elements in a galvanic battery, then probably a great change would come over chemical manufactures. There are three electrical processes for the manufacture of soda now on trial commercially, or for which works will shortly be erected.

With regard to sulphate of ammonia, Mr. Fletcher has been able, as in former years, to collect information respecting the quantity made throughout the United Kingdom. He points out that ammonia is not a manufactured article; all we have being saved as a bye product which was at one time wasted. A large quantity is wasted still (not being collected), or is destroyed by the method of combustion. In a former report under the Alkali Act, by the late Dr. Angus Smith, he showed that the value of the uncollected ammonia from coke-ovens alone in this country amounted to £2,340,000. If to this is added the quantity lost by the present wasteful system of burning coal generally, both in household fires and in factories, the total would be very great. Dr. Angus Smith puts it at £50,000,000. The following table shows the principal sources and the quantity of sulphate of ammonia produced in the United Kingdom in the past four years:—

	1894. Tons.	1893. Tons.	1892. Tons.
Gas-works	113,634 ..	112,179 ..	110,748
Iron-works	10,075 ..	8,833 ..	11,000
Shale-works	32,891 ..	28,485 ..	23,105
Coke and carbonizing works	3,448 ..	3,265 ..	4,973
Total . .	160,048	152,762	149,826

Mr. Fletcher regards with satisfaction the evidence given by these figures of the increased production of sulphate, the value of which now reaches the large figure of £2,000,000 sterling, and therefore constitutes an important addition to the national wealth.

A controversy having not unfrequently arisen as to the best method of treating the sulphuretted hydrogen arising from the manufacture of sulphate of ammonia from gas liquor, Mr. Fletcher offers a few remarks on this matter. He says that undoubtedly the best way of dealing with it, when in sufficient quantity, and generated by a continuous arrangement, is to burn it, so that the resulting sulphurous acid and steam pass into a sulphuric acid chamber, and are there used in the manufacture. Where there is no opportunity for doing this, and the quantity of sulphuretted hydrogen is large, the Claus kiln affords a suitable and economical method of treating it. By this means, a large quantity of sulphur that otherwise would have been sent into the air as a noxious gas is collected in a marketable form. He suggests to future constructors of this form of apparatus that the chamber for collecting the sulphur should be of sheet lead, supported on a wooden framework similar to that of a sulphuric acid chamber. He states that those constructed of brickwork soon show signs of injury from the action of the acid gases which condense in them saturating the mortar and the bricks. If it should be feared that the heat close to the kiln would be too great for the lead, a protection might be furnished by a small amount of brickwork inside the lead chamber; or the heat of the gases might be diminished by lengthening the iron flue-pipe connecting the kiln with the collecting chamber. Where the volume of sulphuretted hydrogen is too small to warrant the use of a Claus kiln, absorption in oxide of iron should be adopted. If arrangements are made for admitting air to the oxide, either while at work or in intervals between the periods of working, the oxide may be kept active until it is completely charged with sulphur. It is only where the amount of sulphuretted hydrogen is very small, as in a village gas-works, that it is admissible to burn it. In such a case, it should be brought under the bars of the boiler fire which works in connection with the process, and so be allowed to pass up through it. The use of a special fire constructed for the purpose of burning the gas should be discouraged, as there is no guarantee that it will always be kept in action. The mere passing of the gases over a fire can never be considered satisfactory.

In order to show the various methods adopted throughout the country for dealing with the sulphuretted hydrogen resulting from the manipulation of the ammoniacal liquor from gas, iron, and shale works, Mr. Fletcher obtained some particulars which he has tabulated. In certain cases, the gases are passed through water containing lime and sulphate of iron in suspension; in others, they go through arsenical sulphuric acid; while in some of the smaller sulphate of ammonia works, the sulphuretted hydrogen is burnt by passing up through the boiler fire. This is done chiefly at small gas-works in the South of England. In the extensive works in the North of England, the continuous system largely prevails. When the process is conducted uniformly, and the sulphuretted hydrogen comes off in an unbroken stream, a much smaller oxide purifier will suffice than is necessary when, under the intermittent system, nearly all the gas comes off in a short time.

Dealing next with tar-distilling works, Mr. Fletcher reports that nearly the whole of them have now been brought into conformity with the requirements of the Act. Most of them needed some alteration, especially in regard to two points. In the first place, the gases which escaped uncondensed from the ends of the still-worms required control. These were mostly hydrocarbon gases mixed with much sulphuretted hydrogen; the exact composition varying with the condition of the distilling operation. These highly offensive gases used to escape freely into the air, and were to a large extent the cause of the nuisance so often complained of. Now, by means of a swan-neck attached to the end of the worm, or of a gas-tight box, these gases are retained, and led away in an iron pipe to some convenient fire and burnt. Some of the tar distillers have preferred an absorption arrangement to that of burning. The second matter in regard to which additional care appeared to be necessary was the pitch-bay. Some minor precautions have also been taken against the escape of noxious gases from portions of the works whence annoyance arose—such as the ventilation of store-tanks for holding tar, gas liquor, &c. Since the general adoption of these precautions, pollution of the air in the neighbourhood of many tar-distilleries has materially diminished.

The report closes with some observations upon coal smoke, open house fires, the testing of chimney gases, and the health of workmen; and it is followed, as usual, by the District Inspectors' reports. These we must leave for notice on another occasion.

EXHIBITIONS OF GAS APPLIANCES.

An exhibition of gas cooking and heating stoves and other appliances was held at Ilkley last week, under the auspices of the District Council and, in connection therewith, well-attended cookery demonstrations were given by Miss Peacock and Miss Holroyd. Since the previous exhibition (held in the spring of last year), the Council have received orders for 138 stoves. An exhibition of the numerous domestic and works shop appliances manufactured by Messrs. Fletcher, Russell, and Co., Limited, for use with gas was held last week, by arrangement with the Bristol Gas Company, in the Lesser Colston Hall, Bristol. The cookery lectures were confided to Miss Rose Brown. Messrs. Fletcher, Russell, and Co., have also been exhibiting at Aberdare, with Miss Lilian Silcox as cookery demonstrator. An exhibition was also held during the week in connection with the Beverley Corporation Gas Department; and practical lessons in cookery were delivered by Miss Grace Holroyd. The Mansfield Town Hall was occupied last week by a collection of gas appliances; and twice each day Mrs. Thwaites, the Principal of the Liverpool School of Cookery, delivered instructive lectures. An exhibition arranged by the Penrith District Council and Messrs. John Wright and Co., of Birmingham, was held at Penrith last week; and lectures on gas cooking were delivered each afternoon and evening. The previous exhibitions held in the town are stated to have brought a large accession of business to the Gas Department. The Davis Gas-Stove Company, Limited, have just held a very successful and well-attended exhibition at the Albert Hall, Portsmouth, with Mrs. Hunter as lecturer on cookery. The exhibition will be continned for another week. The Company have also just concluded a most satisfactory exhibition, under the auspices of the Hastings Gas Company, at the Public Hall in that town. Miss Adelaide A. Hunt demonstrated; and the lectures proved most attractive and interesting. Messrs. W. Parkinson and Co. held a successful exhibition last week in the Institute, Southend; Mrs. Springthorpe giving a series of practical demonstrations in cookery twice daily. It was opened by the Chairman of the Gas Company (Mr. C. Woosnam, J.P.). The same firm are exhibiting this week in the St. John's Hall, March, with Miss E. Sanderson's co-operation as demonstrator. An exhibition, promoted by the London Fire Appliance Company, was held last week in the Victoria Hall, Uddingston; Mrs. Young being the demonstrator.

METROPOLIS WATER SUPPLY.

The Quality of the Water during the Month of April.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the month of April, show that the average daily supply amounted to 228,020,760 gallons, as compared with 195,423,634 gallons in the corresponding month of 1894. The number of services being 814,476, the rate was 280 gallons to each service. Of the entire bulk of water sent out, 114,712,881 gallons were drawn from the Thames, and 113,307,879 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·5; Tottenham, 1·3; East London (deep well) and New River, 1·6; Chelsea, 3·1; Colne Valley, 1·5; West Middlesex, 2·3; Southwark and Grand Junction, 2·5; East London (river supply), 2·6; and Lambeth, 2·8. The unfiltered river waters contained the following proportions: Thames at Hampton, 3·5; New River Cut, 2; and the Lea at Angel Road, 3·8. The Thames at Hampton was, on April 19, turbid and pale yellow in colour. It was of excellent chemical, and fairly good bacterial, quality. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered and improved in chemical quality. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·33; West Middlesex, 99·62; Southwark, (No. 4 filter well) 99·23, (No. 8 filter well) 96·83; Grand Junction, (general well at Hampton) 98·27, (general well at Kew Bridge) 97·7, (Kew south filter well) 99·13; and Lambeth, 98·94. The New River Cut, before entering the subsidence and storage reservoirs, was, on April 22, of excellent chemical, and fairly good bacterial, quality. By passing through the storage reservoirs, it was greatly improved in bacterial quality; and, after efficient filtration, it was delivered in a clear and nearly colourless condition—ranking, as regards chemical quality, with the deep-well waters. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 98·59; No. 1 filter well, 98·79; and No. 8 filter well, 98·99. The water taken from the Lea at Angel Road by the East London Company was, on the 22nd of April, turbid, and pale yellow in colour. It was both chemically and bacterially of fairly good quality, but somewhat inferior in both respects to the Thames at Hampton. After storage for fifteen days, it was greatly improved in bacterial quality; and, after efficient filtration, the total

bacterial improvement was represented by the following percentage numbers: No. 1 Essex well, 98·77; No. 2 Essex well, 99·19; and Middlesex well, 99·1. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, possessed a high degree of organic purity, and were of excellent quality for dietetic purposes. The East London water was, however, very slightly turbid. The Colne Valley Company's supply was softened before delivery, and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the East London deep-well water, very slightly turbid and colourless; the New River, clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, the gravel water used by the Southwark Company, the Thames water after preliminary filtration as used at Kew Bridge by the Grand Junction Company, and the supplies of the various Companies collected on the 19th, 20th, 22nd, and 23rd of April, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw, Stored, and Gravel River Waters.		
Thames at Hampton, April 19	4160	12·3
" after storage for 14·7 days (Chelsea Company), April 19	520	10·7
" after storage for 6 days (Lambeth Company), April 19	720	—
West Middlesex Company's water arriving at Barnes, April 20	500	11·3
Grand Junction Company's water (after preliminary filtration) arriving from Hampton, at Kew Bridge, April 20	180	11·5
Southwark Company's gravel water, April 19	100	13·2
New River Cut before passing reservoirs, April 22	1980	12·8
" " after storage, but before filtration, April 22	700	12·2
River Lea at Angel Road, April 22	4880	12·5
" after storage for 15 days (East London Company), April 22	1540	11·5
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general filter well, April 19	28	10·7
West Middlesex Company's general filter well, April 20	16	11·0
Southwark Company's No. 4 filter well, April 19	32	11·2
Southwark Company's No. 8 filter well, April 19	132	11·4
Grand Junction Company's general filter well at Hampton, April 19	72	12·5
Grand Junction Company's general filter well at Kew Bridge, April 20	96	11·3
Grand Junction Company's south filter well at Kew Bridge, April 20	36	11·6
Lambeth Company's general filter well, April 19	44	11·2
Lea—		
New River Company's general well, April 22	28	12·3
" " No. 1 well, April 22	24	11·9
" " No. 8 well, April 22	20	11·8
East London Company's, No. 1 Essex well, April 22	60	11·5
East London Company's, No. 2 Essex well, April 22	40	11·5
East London Company's, Middlesex well, April 22	44	11·5
Deep well—		
Kent Company's new well at Deptford, April 23	6	11·3

This table shows that the water pumped from the gravel and the Thames water submitted to the preliminary filtration were, for raw waters, of excellent bacterial quality; while, with one exception, the waters delivered by the different Companies had resumed their usual degree of bacterial purity.

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied to London during April, as ascertained by tests of samples taken at various times and places on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 168 samples examined, two were recorded as "clear but dull;" the remainder were clear, bright, and well filtered. The London waters have now assumed the high degree of purity which we are accustomed to observe during the summer, when the activity of fluviatile vegetation, unduly kept back during the abnormally low temperature of the last few months, is fully at work, oxidizing and transforming the dissolved organic matter, and lowering the colour. In chemical composition, the analyses show almost the same results as were obtained in March; a slight improvement being seen in common salt, hardness, nitric acid, and colour. Bacteriologically, the filtered waters from the general wells at the works contained an average of 46 microbes per cubic centimetre; while the unfiltered water contained 9175 per cubic centimetre—showing a filtration efficiency of 99·5 per cent. The rainfall at Oxford has been identical with the average for 25 years; being in each case 1·78 inches. Of this amount, more than one-third fell on April 25.

Carburetted Water-Gas Plant for Hastings.—The Hastings Gas Company have decided to erect carburetted water-gas plant at their Works; and they have entrusted the contract for the complete installation to Messrs. S. Cutler and Sons, of Millwall, E.

Mansfield Corporation Gas Supply.—The Gas Committee of the Mansfield Town Council have reported to the Council that the profit on the working of the undertaking for the year ending March 31 last amounts to £2283, and that they have resolved to reduce the price of gas by 4d. per 1000 cubic feet as from March 31 last.

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the Offices, Marylebone Road, N.W.—Sir W. H. Wyatt in the chair.

The Secretary (Mr. F. H. Wybroo) read the notice calling the meeting. He subsequently read the Auditors' report, in which it was stated that the revenue for the half year ended Lady-day last showed a decrease of £280 on that of the corresponding period of the past year; having amounted to £124,718, as compared with £124,998. The balance to the credit of the dividend and interest account was £60,937. The report of the Directors was taken as read.

The Chairman said the Directors appeared before the proprietors on that occasion under circumstances which had caused great anxiety during the past six months. They were all aware of the dreadful frost which had been experienced, and which had tried the energies of their staff to the utmost. He was assured that such a frost had not been known for 80 years; and he hoped it would be some time before there was another. Almost everything became frozen, including some of their small service mains; and there had been great expense in repairing them, as well as considerable outlay in supplying the consumers with water by other than the ordinary means. He thought they had done quite as well as, and perhaps better than most of the Companies, for all their mains had been repaired now for about six or seven weeks, although it was true that there might be still some to lower. They had gone on the principle that wherever a main froze and it was less than 3 feet deep, it should be replaced by a fresh one placed 3 feet deep. They hoped that this would be satisfactory. It entailed great expense; but they thought it best to do what they could, even if it necessitated great outlay, rather than run the risk of a similar experience another time. Some of the parishes treated them a little hardly, in trying to make them pay for removing the ice which collected round the stand-pipes. This the Company refused to do. They answered: "If you do not wish the stand-pipes placed in your parish, and will take the responsibility of telling us not to place them there, we will not do so." They did not, however, like to take this responsibility; and most of them had abandoned the claim previously raised. It was far more pleasant for him to state that they received considerable assistance from all the parishes in hiring their water-carts at a reasonable rate; and by this means the Company were able to supply their customers with water. This was a great convenience to the consumers; but, so far as the Company were concerned, it entailed considerable expense, which, moreover, they were not obliged to undertake. He should be ungrateful if he did not say at once that they owed a debt of gratitude to their officers generally, who were overworked for a long time. It was true that they afterwards received a gratuity; but still they were kept working too long. This, however, could not be helped, because strangers could not do the work. There was therefore no alternative but to let their men work exceptionally long hours, or allow their customers to go without water. The two new engines and boilers referred to in the last report as being erected at Willesden were now very nearly completed; and he hoped they would soon be at work. They had established a new overhead system of unloading coal at the works at Hammersmith, from which they expected to derive a considerable saving in the cost of delivering the coal. They had entered into a contract with Messrs. John Aird and Sons for building four storage reservoirs at Barnes. This was a great work, and would involve a heavy cost; but they were glad to think that the firm he had mentioned had undertaken the contract, and at less than the Company's Engineers estimated would be the cost. It was everything in such an important matter as this to have first-class Contractors, who knew their work, and who had the plant to carry it out. They were putting up a new Worthington engine at Hampton, to replace the last remaining Bull engine. This would also entail considerable expense; but it was probably the best and cheapest thing they could do. There had been no great increase in the number of supplies in the past half year. For three months out of the six, indeed, it was impossible to lay on a fresh supply, owing to the frozen state of the roads. Probably the matter of greatest importance to which he had to refer on that occasion was the action of the London County Council in bringing in eight separate Bills for the transfer of the undertakings of the Metropolitan Water Companies. The expense of this proceeding was enormous; and when it was going to end he did not know. Through the action of the County Council, they had been mulcted every year in a large amount for costs. This was most objectionable; and when they came to think that besides this the Company paid the parishes about £25,000 a year, they would recognize that it was not all profit to fit out a water supply. They were represented in Parliament by their energetic Director and Deputy-Chairman, who did all he could to prevent mischief from being done; and he hoped that they might get out of this difficulty better than they had thought. He concluded by moving the adoption of the report and accounts.

The Deputy-Chairman (Mr. E. Boulnois, M.P.) seconded the motion, which was at once carried unanimously, without discussion.

The Chairman then proposed the payment on and after the 5th of June, of a dividend for the half year ended March 31 on the consolidated stock at the rate of 10 per cent. per annum, less income-tax.

The Deputy-Chairman seconded the motion, which was carried unanimously.

Resolutions were afterwards passed re-electing the retiring Directors (Mr. J. Pomeroy, the Hon. Baron Dimsdale, Mr. H. W. Prescott, and Mr. E. Cumberlege) and the Auditors (Messrs. H. R. Solly, C. R. S. Dimsdale, and G. Pitt).

On the motion of Mr. Givens, a resolution was passed thanking the Chairman and Directors for their diligent attention to the business of the Company, and their able and satisfactory management of its affairs.

The Chairman, after acknowledging the vote, stated that the meeting was now made special, to consider the creation and issue of the debenture stock authorized by their Act of 1894. Parliament last year gave them power to raise £440,000 for the new works they contemplated. They were obliged to raise it in a particular way—by a 3 per cent. debenture stock, on such terms as the Governor of the Bank of England might think most expedient. The

East London Company had already raised £100,000 out of the £500,000 authorized; and he believed they had obtained about 103½ per cent. for it, or rather more. It was, as he had said, a 3 per cent. debenture stock, which might be repayable in 25 years, although it was not necessarily repayable then. The Directors thought it was best to ask the proprietors to give them power to raise the whole of the £440,000, though their idea at present was to raise only £100,000 in the first instance. Part of this amount, or the whole of the £100,000, would be required in September, or at all events at the beginning of October; and the Contractors were now drawing upon them largely. He concluded by moving—"That the debenture stock authorized to be raised by the West Middlesex Water-Works Act, 1894, be, in exercise of the powers conferred on the Company by that Act, hereby created; and that the stock thus created be issued and disposed of by the Directors in such proportions, on such terms and conditions, at such times, and in such manner, consistent with the provisions of the said Act, as may by the Directors be deemed expedient from time to time." The proprietors could not, he added, get the least individual benefit out of the stock. Notice would be sent to them with a form of tender; but those who tendered the highest price would get the stock, whether they were proprietors or not.

The DEPUTY-CHAIRMAN seconded the motion, which was carried unanimously; and the proceedings then terminated.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The subject of disclosing the terms of individual tenders in connection with contracts for supplies, formed a topic for consideration by the Greenock Gas Trust this week. The minute of the Committee was to the following effect: "The Committee agreed respectfully to state that, in deference to the expressed desire of many of the coalmasters, as well as in the interests of the gas-works, it had always been held to be inexpedient to disclose the various contract prices of coal purchased by the Committee from time to time, either in the open minutes or the appendix thereto; but complete details of these contracts are set forth in the written records of the Committee's proceedings. The Committee, having regard to the entire circumstances, are of opinion, and strongly recommend, that the existing practice should be adhered to; but authorized the Convener to state verbally to the Board the average price of the recently concluded contracts for coal. The current contracts for gas oil were concluded in the open market upon specifications of the requirements, prepared and issued to the leading firms in the oil industry in Scotland, who submitted tenders." Of course, with Bailie Cluchie present, it was impossible that such a statement should escape unnoticed, for the Bailie is a keen hunter after out-of-the-way points. On this occasion, he thought the minutes were incomplete; and that there was a "hide-and-seek" manner of dealing with gas affairs which he did not like. This expression was objected to; and he changed it from "hide-and-seek" to "child's play," whereupon a remark was made implying that the child's play was introduced by himself. Like so many other of Bailie Cluchie's mares' nests, this one ended in nothing being done, except that Bailie M'Innes stated that the gas minutes contained statements as to the amount of coal, from whom it was purchased, and the price per ton; and any member could get all the information asked for by going to the Clerk's room.

The workmen in the employment of the Greenock Gas Trust recently petitioned that their hours of work should be reduced from 60 to 54 per week. This week the Commissioners have resolved to grant a reduction of three hours per week; making the working week 57 hours. One member said he was prepared to move that the whole request be granted. He did not seem to have any support in this; and he had to content himself with the remark that he was satisfied nothing more could be done in the meantime, and that he was pleased a reduction of hours was being given.

The Gourock Police Commissioners, having had their proposal to erect a gasholder in the town sanctioned by the Sheriff of the county, have this week resolved to proceed with the work. Mr. J. M'Gilchrist, of Dumbarton, has been appointed Engineer for the work. To defray the cost, the Commissioners have arranged a loan from the Northern Assurance Company of £3000, of which they have resolved to call up £1500 in the meantime.

The benefit of vigilant management in connection with a gas-works could scarcely be better illustrated than by the case of Forfar. For a number of years Forfar, in the matter of gas supply, was in the way of going back. The late Manager (Mr. Esplin), as is well known, was long in indifferent health; and the business was conducted in a not too enterprising manner. All this is changed now. The new Manager (Mr. Forbes Waddell) is a young man, with modern ideas as to the manufacture of gas, and a good knowledge of the commercial side of gas undertakings, which is an equally indispensable qualification. Where this shows to advantage is made apparent this week in connection with the coal contracts, which were concluded on Monday night. The quantity contracted for is 3500 tons; and the average price is 15s. 9d. per ton, as compared with 19s. 1d. last year—a saving of 3s. 4d. per ton. Such a heavy drop must make a great difference upon next year's balance-sheet; and it entirely justifies the Commissioners in their appointment of Mr. Waddell. The Commissioners are at present doing a little to bring the gas-works—which had been allowed to fall behind in some respects—into something of an up-to-date condition; and they have this week let the contract for the providing of new purifiers to Messrs. R. Dempster and Sons, at the price of £484; exclusive of fitting up. It was reported to the Commissioners that the output of gas from the works during the past month exceeded that in the corresponding month of last year by 75,300 cubic feet, which is another proof that efficient management, though it may cost more, pays in the end.

The Strathmiglo Gas Company, which is one of the many small gas undertakings in Fifeshire, about a year ago converted their works into an oil-gas works. It is now announced that "a superior light was obtained; but the difficulties attending the making of it, and the loss to the Company, have been so great that it was found impossible to continue it." It has accordingly been resolved to re-convert the works into a coal-gas works. This is unfortunate; but I am not surprised at it. There is no oil-gas process which, if worked alone, would be profitable for a general supply of gas. The Company's works are probably too small to make enrichment by any process pay; but had they been large enough, and the Company had adopted the Peebles system, there would have been no need for going back to coal alone.

The Falkirk Gas Commission have not had long to wait before receiving practical illustration that they may not always look for fair weather and plain sailing. Yesterday, as workmen were altering a portion of the retort-house, so as to adapt it for the Peebles process of oil enrichment, the roof of the building fell in. Fortunately none of the workmen were injured. The Works Committee met in the evening, and arranged for the re-construction of the roof. The incident is in itself a small one; but if, for instance, any of the workmen had sustained injury, it would have affected the expected benefit from their economies. I do not think the Commissioners have a contingency fund yet; but this should show them the necessity for the institution of one, if their estimates are to turn out right.

At the meeting of the Arbroath Gas Corporation on Tuesday night, it was reported that only one offer had been sent in for the secondary products for the year. This was by Mr. W. Briggs, of Dundee; and was at the rate of 3s. 9d. per 100 gallons of tar and liquor mixed. The offer was considered to be too low; and a Sub-Committee recommended that it be declined. In connection with this subject, the Manager (Mr. R. S. Carlow), brought under the notice of the Committee the possibility of their benefiting by the introduction of plant for the working up of the secondary products themselves. Mr. Carlow intimated that there was a sulphate plant in the Inverness Corporation Gas-Works of a sort which would be quite suitable in Arbroath. It was resolved to send two of the Commissioners and Mr. Carlow to Inverness to see the plant there. Mr. Briggs thereafter increased his tender to 4s. per 100 gallons; but this was still considered unsatisfactory, and the Corporation resolved to adhere to their former decision.

The Water Committee of the Aberdeen Town Council on Thursday visited their works at Invercannie, where the city water supply is abstracted from the River Dee, on a tour of inspection, preparatory to improvement works which are contemplated. These consist of alterations upon the intake from the river and the outlet from the settling-pond, and also the treatment of the sides and bottom of the settling-pond, which at present are in such a condition that they give encouragement to the development of objectionable forms of animal life. This latter work, it is estimated, will cost £3000; but it is looked upon as a necessity that something be done.

Both in Glasgow and Dundee last week the question of defraying the cost of inspections of water-works was discussed. In the Dundee Town Council, it was stated that the inspection of the Lintrathen works last year cost £114; and a motion was made that the amount expended this year should be limited to £80, and that nobody except members of the Council and the officials should be invited. A counter-motion, however, approving of the limit of the money, but not of the number attending, was carried; the feeling being that there were gentlemen outside whom it would not do to overlook. This feeling, I fear, must give way before the opinion expressed by Sir James Marwick, the Town Clerk of Glasgow, to his Commissioners on Thursday, and which forms the more important of the two incidents. Sir James said that, at a previous meeting, reference had been made to a decision on the subject in the Supreme Court in Ireland, as affecting the Dublin Water Commissioners. It seemed to him that on the great majority of points this decision simply affirmed and applied in Ireland what had been recognized for a very long time as the law in Scotland. It was laid down by the Court of Session in the case of the Dundee Police Commission, and also of the Edinburgh Water Commission—and the rule then laid down might be looked upon as an axiom of Scottish, as well as of English and Irish law—that where a public body of men were acting as Trustees under an Act of Parliament, they only received the protection of the law in the exercise of the strict powers which the Act laid on them. The general law was quite plain. It was perfectly clear that the Trustees would not be entitled to spend Trust funds for any purpose other than those authorized by the Act of Parliament. They would not be allowed to charge Trust funds with the expenses of feasting, or anything of that description. In the case of Glasgow, the whole Town Council were Water Commissioners; and there was laid upon them the responsibility of seeing that the very large works which were in progress in connection with the water supply were properly executed. It seemed to him that nothing could be more clear than that those gentlemen on whom the law had laid this responsibility should have the opportunity given to them of relieving themselves of it by visiting the works. He had no doubt, therefore, that the Town Council, or Water Commissioners, were entitled to visit the works and to the charges for conveyance, and to have reasonable and moderate provision during their absence. Of course, that excluded persons who were not Commissioners, and who had no statutory responsibility, and also excluded what had been excluded in Ireland—namely, wasteful extravagance. Mr. Osborne asked what about guests? Sir James Marwick replied that he was afraid the expenses of guests could not be charged against the Trust funds, and that gentlemen who invited guests must make provision for them.

Redwood's Vapour and Inflammable Gas Detector.—The Gas Lighting Improvement Company, Limited, have been appointed sole agents for the sale to gas companies of this apparatus, which was described and illustrated in the JOURNAL last week (p. 1082).

Coventry Corporation Gas Department.—The annual report of the Gas Committee of the Coventry Corporation (which was submitted at last Tuesday's meeting of the Council), shows a net surplus profit of £5600, as against £3249 in the preceding year. The Committee have decided to reduce the price of gas after June 24 to 2s. 5d. within the municipal boundary and to 2s. 11d. outside. Some further particulars from the report and the speech made by the Chairman of the Committee (Mr. W. Andrews) in moving its adoption, will be given in next week's issue.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 25.

Sulphate of Ammonia.—During this last week, the market has experienced a further decline. This is not accounted for by the demand, which has been moderate, and would no doubt have been larger, but for pessimistic reports which have been persistently circulated. Neither is it accounted for by the action of makers, who have not been pressing spot stuff, and who have all along refused to sell ahead, unless at a stiff premium. It is the dealers, who have been selling for delivery over autumn months, and even further ahead, at but a small premium upon the level of present values, and whose interest it is, by any means, to damage the spot market as much as possible, to enable them to cover their forward sales to advantage; and it will be well for makers to keep this in mind. Spot quotations are, as might be expected, very irregular; ranging from £9 15s. to £9 12s. 6d. per ton, f.o.b. at the ports.

Nitrate of Soda is firm; and the value of fine quality on spot is 8s. 3d. per cwt.

LONDON, *May* 25.

Tar Products.—There is no change for the better in benzols and solvent naphtha. They continue flat, with a tendency to still lower values; and, although the production from tar is falling off rapidly, as is usual at this season of the year, it forms such a relatively small proportion compared with benzols produced from coke ovens, that it has little or no influence upon market quotations. Pitch is firm; and stocks in distillers' hands are undoubtedly low. There is no new feature in carbolic acid. But it holds the advance it recently acquired; and a steady business is being done in all kinds of carbolic products. Low prices are mentioned in connection with creosote and common oils. Anthracene is held firm at Committee rates. Prices for the week may be taken as follows: Tar, 18s. to 22s. Pitch, 32s. West Coast ports, and 35s. East Coast ports. Benzols, 90's and 50's, 11d. Solvent naphtha, 1s. Toluol, 1s. Crude, 30 per cent. naphtha, 4d. Creosote, liquid, 1½d.; ordinary, 1d.; salts, 20s. Cresylic acid, white, 1s. 2d.; "brown," 11d. Carbolic acid, 60's, 1s. 9d. Anthracene, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia has further receded in value. A fair amount of business is being done both for prompt and forward delivery. For early delivery not more than £9 10s. to £9 12s. 6d. is obtainable, though there is some difference in values at various ports, as will be seen by the following quotations: London, Beckton, £9 15s.; outside makes, £9 11s. 9d. Hull, Newcastle, and Leith, £9 10s. Liverpool, £9 13s. 9d. Gas liquor, 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Several of the less important gas-coal contracts in this district have been placed during the last week or so. I hear that the Belfast contract has also been concluded; but at what price, I am unable to state definitely, except that tenders from Wigan collieries were sent in based on about 7s. per ton for partially-screened Arley at the pit. I believe the prices settled upon for delivery at Belfast range from 11s. 6d. to 12s. 6d. per ton. In regard to the local contracts, prices continue as low as ever. Good Wigan four-feet gas coals do not average more than 6s. 6d. per ton at the pit mouth; and partially screened Arley gas coals, 7s. Quotations in some cases are 3d. under these figures; the exceptionally small margin between these two qualities inducing many consumers to give preference to the Arley coal. Good Yorkshire gas coal has also been taken at very low figures, which I understand would leave very little more than 5s. per ton for unscreened, to 5s. 6d. and 6s. for screened gas coal. With regard to locomotive fuel, contracts are now being generally settled on the basis of 6s. 3d. per ton at the pit mouth, representing, as previously stated, a reduction of 6d. on last year's prices. In the general run of round coals, both for house-fire and manufacturing requirements, trade continues extremely quiet; pits in many cases being put on to about three days per week, to prevent further accumulations of stock, while four days per week may be taken as the full average that the collieries throughout the district are working. Quoted rates for best Wigan Arley remain at 10s. to 10s. 6d. per ton at the pit; seconds Arley and Pemberton four-feet, 8s. 6d. to 9s.; and common house coals, 7s. 6d. to 8s. Common round coals, for steam and forge purposes, are also offering extremely low—not averaging more than 6s. 6d. upon inland sales, and even less than this for shipment. Steam coal, delivered at the ports on the Mersey, does not average more than 7s. 6d. to 7s. 9d. per ton. With the present very limited production of slack, engine fuel meets with a fair demand; and prices are generally well maintained at late rates—the better qualities averaging 4s. 6d. to 5s. per ton at the pit mouth, and common slack 3s. 6d. to 4s.

Northern Coal Trade.—There has been a little more animation of late in the coal trade of the North, both as regards steam and gas coal branches, though most markedly in the latter. The opening of the Baltic ports has stimulated the shipments; and in consequence there is a better production of coal at most of the collieries. In one or two cases, the prices of coal are firmer, with a slight tendency to advance. Best Northumbrian steam coals are quoted 8s. 9d. to 9s. per ton f.o.b.; second qualities, 8s. to 8s. 6d.; and steam smalls, 3s. 6d. to 3s. 10½d. Manufacturing coals are now quiet, as the demand is only moderate at present, though it is rather fuller than it was a few weeks or so ago. In regard to gas coals, the interest has centred in the decision of some of the contracts for local companies, which have been allotted. As the rate of carriage is in part included, quotation is rather difficult; but in one instance it seems to be tolerably certain that the delivered price will be about 7s. per ton—or equal to perhaps 6s. 3d. per ton f.o.b.; while others are allotted at prices that will be somewhat lower. The tendency of the gas coal trade must therefore be said to be rather weak and unsettled, though it is probable that for odd cargoes rather higher prices will be generally asked. Coke is only in very moderate export of late; but the local consumption is better, and the price is maintained at from 12s. 6d. to 13s. 6d. per ton f.o.b. There is no alteration in the price of gas coke; but the production is now at about its lowest ebb, so that the stocks are being reduced by a considerable shipment. Some anxiety is locally felt at the result of the threatened strike of workmen on one of the great mineral carrying railways of South Wales, which would seriously affect the coal trade.

Scotch Coal Trade.—There is continued depression in the coal trade in Scotland. Prices have fallen so low that in many instances they are unprofitable to the coalowner. Further falls are not, therefore, expected. The demand for all sorts is light. The miners are getting only about half time; and this reduction of the output has had the effect of making some gas people fix their contracts earlier than usual, for fear there should be, in the event of the restriction leading to lessened supplies, a stiffening of prices. The rates quoted are: Main, 5s. 10d. f.o.b. Glasgow; ell, 6s. 9d. to 7s. 3d.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d.. The shipments for the week amounted to 169,320 tons—an increase compared with the previous week of 8209 tons, and of 16,423 tons compared with the corresponding week of last year. For the year to date, the total shipments have been 2,347,343 tons—a decrease on the quantity in the same period last year of 391,003 tons.

Sales of Shares.—The following shares have recently been sold by public auction: 600 £10 "D" shares in the *Willenhall Gas Company*, at from £14 7s. 6d. to £15; £30 shares in the *Yarmouth Gas Company*, at £46 10s. and £47; 100 fully-paid £1 shares in the *East Ardsley Gas Company*, at £1 8s. each.

Monte Video Gas Company, Limited.—At the meeting of this Company next Friday, the Directors will report that the profit on the working of the year ending Dec. 31 last is £31,114, which has been passed to the credit of profit and loss. From this latter account, provision has been made for interest on debentures, for income-tax, and for bad and doubtful debts; and £1850 has been written off capital expenditure for depreciation. The sum of £2000 has been transferred to the reserve account, which now stands at £74,000; and £500 has been added to the insurance fund, increasing it to £12,500. The balance then remaining at the credit of profit and loss, available for dividend, is £32,229. Of this, the Directors paid on Nov. 22 last an interim dividend of 10s. per share; and they now recommend the payment of a further 10s. per share—making together a dividend of 5 per cent. for the year. This will absorb £27,096, and leave £5133.

A Leaky Reservoir.—At the last meeting of the St. Germans Rural District Council, Mr. Masterton presented a report on the subject of the leakage in the reservoir recently constructed at Millbrook. The fault was not at the bottom of the reservoir. A considerable flow of water took place just below the pure water reservoir into the original stream at the boundary fence; and if this came from the reservoir, it might account for a great proportion of the loss. He had opened up the ground a little, to ascertain, if possible, the direction whence the water came; but he could not go far enough without more help. This was a point that should be followed up; but it would be necessary to employ labour to do it. He had not certified the completion of the work; and any operations that might be undertaken must be placed in the hands of the Contractor. He added that a workman volunteered the statement that the puddle had been left out of a length of from 12 to 14 feet in the tunnel in which the outlet-pipes were laid, and that at other points there were merely puddle walls 2 or 3 feet thick, with empty spaces between. He also alleged that on the west side of the embankment, immediately under the overflow channel, a slip took place before the trench was filled in, and that the loose earth was not cleaned out, but the puddle filled in on the top of it. These, Mr. Masterton, pointed out, were serious allegations; and he suggested that, if a Committee thought there was anything in the statement, after hearing the man, the place should be opened, and the matter tested. If the story was correct, the Contractor would have to make the puddling good. A Committee is to go into the question.

The Payment of Water-Rates for Periods of Non-Supply.—The requisitions sent to the Lambeth and Grand Junction Water Companies, asking, *inter alia*, for the remission of a portion of the water-rate for the period of non-supply during last winter, have been replied to by the Secretaries of the respective Companies (Messrs. H. Wilkins and J. Goodwin). Mr. Wilkins points out that the obligation that is imposed upon the Company by statute is not (as the memorialists appear to assume) to deliver water into houses, but to keep their mains charged with water except when prevented by frost and certain specified causes; and the Company have not only fully discharged this obligation, but, when the direct supply failed in consequence of the frost, they voluntarily and promptly adopted, at considerable additional outlay, such means as they could to mitigate the inconvenience resulting therefrom. His Directors, he says, think it is only necessary to point out these facts to show the unreasonableness of the request of the memorialists not only to be supplied without charge with water which cost the Company a considerable sum to impound, filter, pump, and distribute, but actually to be paid for obtaining such water. Mr. Goodwin states that he is instructed by his Directors to point out that, in the Acts of Parliament governing the water supply, the respective obligations of the consumer and the Company are very precisely laid down—there are express enactments having reference to the possibility of interruption of the supply by exceptional circumstances such as frost; and in view of this, the amount of the water-rate and the mode of payment are definitely fixed. The Directors sincerely regret that the memorialists should have suffered inconvenience; but, under the circumstances, they are unable to comply with their request. Lieut.-Col. Strettell, the Secretary of the Water Consumers' Defence Committee (formed at a recent conference at Surbiton), has replied to these communications, informing the Companies that the Committee are determined to resist the levying of the full water-rate, and are prepared to arrange with the Companies to secure an early decision from the proper legal tribunal. The Committee propose that one test case should be taken by the Lambeth and Grand Junction Companies together; the circumstances being the same in each Company's district. The Committee further intimate that, on hearing from the Companies, they will nominate gentlemen prepared to become defendants in the action.

Reduction in Price.—The Directors of the Pudsey Gas Company have decided to reduce the price of gas from 2s. 9d. to 2s. 7d. per 1000 cubic feet, to take effect from July 1 next.

The Supply of Water for Manufacturing Purposes at Middlesbrough.—At the meeting of the Stockton and Middlesbrough Water Board held on the 13th inst., the General Manager (Mr. D. D. Wilson) reported that during the past quarter 310,263,000 gallons of water had been sent out by the Board for manufacturing purposes—this being the largest quantity on record. The supply in the Stockton district showed a slight increase; but the return was considerably below the maximum. The quantity delivered to the Eston district had fallen from 137,000,000 gallons in the corresponding quarter of 1894 to 122,000,000 gallons.

The Proposed New Water Supply for Nottingham.—At a recent meeting of the Sutton-in-Ashfield District Council, attention was called to the action of the Nottingham Corporation in seeking new sites for water-works, to which reference was made in the JOURNAL last week. The Consulting Water Engineer (Mr. Hodson) wrote to the effect that a pumping-station three miles north of Papplewick would be between the Rainworth and Sutton works, and would prejudicially affect the Council's works and those of the Mansfield Corporation. A Special Committee was appointed to oppose, by all legitimate means, any attempt of the Nottingham Corporation to establish water-works which might prejudice the Sutton supply, and to unite, if necessary, with the Mansfield Corporation in so doing.

The Yeadon Rotary System of Gas Making.—Last Thursday, the members of the Leeds Gas Committee, accompanied by the Managers of their works, visited the Willow Place Gas Yard, to inspect the Yeadon revolving gas-retort in operation there. This has recently been fitted with a corrugated steel body, by the adoption of which it is claimed that nearly double the conductive heating surface is secured in addition to increased strength and durability. We learn that the Committee were very favourably impressed with their inspection of the working of the retort, which was producing 22-candle gas from small coal, without the addition of any cannel or other enriching material. The Yeadon Gas-Retort Company, Limited, the owners of the invention, are arranging for trials to be made by the Leeds Committee, to satisfactorily test the advantages claimed for this system, with the view of adopting it at one of their works.

Plymouth Water Supply.—At a recent meeting of the Plymouth Corporation, Mr. Bond, in moving the adoption of the Water Committee's report, said they were as diligent as ever in developing the revenue of the property, and exercising a wise control over the expenditure in connection with it. The estimated receipts for the ensuing year were £16,750; those for the preceding year being £15,250. The former sum included £650 which was due from the Devonport Water Company for water supplied during the drought. This need on the part of the Company was likely to recur so long as they did not care to make an enormous outlay on capital account in piping their leat; and the result was that, while it would not punish their neighbours, it would be the means of adding to the receipts of the Corporation. By securing the services of Mr. J. Mansergh, they had obtained the assistance of one of the first engineers of the day. A satisfactory matter worth mentioning was the ending of the long-standing dispute with the Admiralty as to the number of gallons of water contained in a tun. The Board of Trade had decided in their favour, with the result that the Corporation would save 6 million gallons a year, or, if required, would have to be paid for them. Arising out of a claim in respect of the dispute, £170 was due from the Admiralty. Replying to Mr. Radford, Mr. Bond said that, in appointing Mr. Mansergh, the services of Mr. Sandeman, their Water Engineer, had not been lost sight of. The Mayor (Alderman Law) expressed his pleasure at hearing this, and said Mr. Mansergh had complimented the Corporation upon having the services of so able an Engineer. The motion was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1136.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Pa'd per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	21½–22½	..	4 13 4
100,000	10	,,	7½	Do. 7 p. c.	10	14½–15½	..	4 16 9
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 4
200,000	5	10 May	6½	Bombay, Limited	5	6¾–7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	4¾–5¼	..	4 19 2
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	245–250	+2	4 12 0
180,000	,,	,,	8½	Do. New	100	195–200	..	4 5 0
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220–225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	120–123	..	4 1 4
320,000	20	28 Mar.	11½	British	20	51½–52½	+½	4 5 8
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	21¾–22¾	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16¾–17¾	..	4 17 2
328,750	10	14 Nov.	4†	Buenos Ayres (New) Limited	10	7¼–7¾	+¼	5 13 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100–103	..	5 16 7
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26½–27½	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	290–295	+7	4 11 6
165,000	,,	,,	10½	Do. New do.	100	214–219	+2	4 15 10
160,762	,,	13 Dec.	4½	Do. 4½ p. c. Deb. do.	100	138–143	+8	3 2 11
800,000	Stck.	13 Dec.	13	Continental Union, Limited.	100	252–257	+2	5 1 2
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	205–210	..	4 15 3
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. S k	100	120–125	..	4 4 0
486,090	10	31 Jan.	11	European, Limited	10	24–25	..	4 8 0
354,060	10	,,	11	Do. Partly pa d	7½	17–18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100*	272–277	+2	4 6 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105–110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277–282	+2	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197–202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	188–193	..	3 12 6
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275–280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	163–168	..	3 11 5
1,061,150	,,	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	129–132	..	3 0 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140–145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	188–192	..	3 2 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	243–248	+4	4 16 9
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5½–6½	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	110–112	..	4 9 3
541,920	20	14 Nov.	5	Monte Video, Limited	20	15½–16½	..	6 1 2
150,000	5	24 May	8	Oriental, Limited	5	7–7¼*	+¼	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾–5¼	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1¾–2¾	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102–106	..	5 13 2
500,000	100	1 Dec.	6	2nd Do.	100	102–107	..	5 12 1
150,000	10	26 Apl.	7	San Paulo, Limited	10	8¾–9¼	..	7 7 4
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	350–360	..	4 6 1
1,350,000	,,	,,	12	Do. B do.	100	295–300	+2	4 0 0
290,000	,,	,,	13	Do. C do.	100	307–312	..	4 3 4
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	168–173	..	2 17 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	28 Dec.	10½	Chelsea, Ordinary	100	277–282	..	3 11 9
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	215–220	..	3 12 9
654,740	,,	28 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	151–156	..	2 17 8
700,000	50	13 Dec.	8½	Grand Junction	50	107–111	..	3 16 7
708,000	Stck.	14 Feb.	12	Kent	100	304–309	..	3 17 8
1,043,800	100	28 Dec.	7½†	Lambeth, 10 p. c. max.	100	232–237	..	3 3 3
406,200	100		7½	Do. 7½ p. c. max.	100	200–205	..	3 13 2
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	136–140	..	2 17 2
500,000	100	14 Feb.	12½	New River, New Shares	100	350–360	..	3 10 9
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	140–143	..	2 15 11
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	141–146	–2	4 2 2
126,500	100	,,	6	Do. D 7½ p.c. do.	100	138–143	..	4 3 11
1,155,066	Stck.	Dec. 13	10	West Middlesex	100	270–275	+1	3 12 9

*Ex div.

† Next dividend will be at this rate.

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Address No. 2532, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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TAR DISTILLERY "PERSEVERANTIA," LIMITED, Harlingen, HOLLAND.

TAR.

REQUIRED about 50 or 60 Barrels, made at a Gas-Works where Petroleum is not used, and not too far from London.
Address W. BAILEY, 29, Stephenson Street, LONDON, E.

FOR SALE—One 2000 Cubic Feet per hour EXHAUSTER, by George Waller.
Offers to be sent to B. GIBSON, Engineer and Manager, Gas-Works, HAVERHILL.

FOR SALE—Single-Lift Gasholder, 36 feet diameter by 10 feet deep, with Cast-Iron Columns and Counterbalance Weights, complete and in good condition.
Apply to G. HELPS, HINCKLEY.

PURIFIERS.

FOR SALE—Four 8 feet square Purifiers, with Sieves, Bearing-Bars, and Covers. Being removed to make room for larger ones.
Apply to the MANAGER, Gas-Works, Banbury, OXON.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

THE Undersigned is in a position to supply, at the very lowest Prices, the most suitable kind of BENZOL for enriching Gas, made from Hardman's Patent Carbonization Process, of which I am the Sole Patentee. On application, I would furnish Price on the most reasonable terms; giving advice how to utilize it on the most economical method.
J. HARDMAN, Manufacturing Chemist.
Milton, Staffs.

NEW Design of Rotary Pump and Non- fluctuating GAS EXHAUSTER, PATENT of which is FOR DISPOSAL, on Royalty or otherwise.
Address P 422, *Engineer* Office, 33, Norfolk Street, LONDON.

FOR SALE—A Station Gas-Meter (nearly new) of 7000 Cubic Feet per hour capacity, by J. & J. Braddock. It has only been in use about eighteen months. Also a STATION METER of 10,000 Cubic Feet per hour capacity, by W. Parkinson and Co., London, both in first-class condition.
Can be seen at any time on application, by letter, to No. 2531, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

STATION METER.

THE above Company have for Sale a STATION METER, which is being replaced by a larger one. Capacity 1200 cubic feet per hour. The Meter is in good condition, and may be seen by appointment, or particulars will be forwarded on application to the undersigned.
JAMES LEE,
Secretary and Manager.

MATLOCK AND DISTRICT GAS COMPANY, LIMITED.

FOR SALE—A Single-Lift Gasholder, 40 feet diameter, in good order, with Cast-Iron Columns and Counterbalance Weights complete; being replaced by larger one.
Further Particulars may be had on application to Mr. T. Brown, Manager, Gas-Works, Matlock.
Offers to the undersigned.
ROBERT HALL,
Secretary.
Gas Office, Crown Buildings,
Matlock, May 18, 1895.

FROME GAS COMPANY.

THE Directors of the Frome Gas Com- pany are prepared to receive TENDERS for the supply of from 500 to 4000 Tons of best screened GAS COAL, to be delivered at the Gas-Works Siding between July 1, 1895, and June 30, 1896.
Tenders to be endorsed "Tender for Coal," and delivered to the undersigned on or before the 22nd of June, 1895.
The Directors do not bind themselves to accept the lowest or any tender.
H. F. VINCENT,
Manager.
Frome, May 24, 1895.

ALTRINCHAM GAS COMPANY.

COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL and CANNEL for One, Two, or Three Years from the 1st of July next. Deliveries to be free at the Gas-Works Siding Altrincham Railway Station as required.
Sealed tenders, endorsed "Tender for Coal and Cannel," stating the description of the Pits from which they are to be raised, the amount proposed to be supplied, and cash terms for monthly payments, to be sent addressed to the undersigned, so as to be received not later than Twelve o'clock Noon, on Tuesday, the 11th day of June, 1895.
The Directors do not bind themselves to accept the lowest or any tender; but the person or persons whose tender may be accepted will be required to execute an Agreement for the due performance thereof.
No special form of tender is required or supplied.
F. R. B. LINDSELL,
Secretary.
Gas Offices: Moss Lane, Altrincham,
May 21, 1895.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of 50,000 Tons of GAS COAL and 10,000 Tons of CANNEL COAL, to be supplied in such quantities as may from time to time be determined by the Gas-Works Committee during the Year ending the 31st of July, 1896.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, Manager, Gas-Works, Halifax.

Tenders, endorsed "Tender for Coal," must be sent to me before Ten a.m., on Wednesday, the 5th of June, 1895.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of

(1) WROUGHT-IRON TUBES and FITTINGS.
(2) CAST-IRON PIPES.
(3) LIME for GAS PURIFICATION.
(4) SULPHURIC ACID 750 TONS.
(5) OXIDE of IRON.

For the Twelve Months ending the 30th of June, 1896.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, Engineer, Gas-Works, Halifax.

Tenders, properly endorsed, to be sent to the undersigned before Ten o'clock a.m., on Wednesday, the 5th of June, 1895.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

HALIFAX CORPORATION GAS-WORKS.

THE Halifax Corporation are prepared to receive TENDERS for the purchase of SPENT OXIDE OF IRON, RETORT CARBON, and BRIMSTONE for the Year ending the 30th of June, 1896.

Full Particulars and Forms of Tender may be obtained on application to Mr. Thomas Holgate, F.C.S., Gas-Works, Halifax.

Sealed tenders, endorsed "Spent Oxide of Iron," "Carbon," or "Brimstone," as the case may be, to be delivered to the undersigned not later than Ten a.m., on Wednesday, the 5th of June, 1895.

The Corporation do not bind themselves to accept the highest or any tender.

KEIGHLEY WALTON,
Town Clerk.

BOROUGH OF DEWSBURY.

THE Lighting Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works, Savile Town, near Dewsbury, of the following quantities of GAS COAL, during a period of One, Two, or Three Years, commencing on the 1st day of July next:—

First Year	17,000 Tons.
Second Year . . .	17,500 Tons.
Third Year	18,000 Tons.

Tenders must specify prices for delivery by Road, Rail, or Water, and be made on forms to be had on application to Mr. Charles A. Craven, Engineer and Manager, Savile Town Gas-Works, Dewsbury, from whom any further Information can be obtained.

Sealed tenders, endorsed "Tender for Gas Coal," to be sent to E. Mawdesley, Esq., Town Clerk, Dewsbury, not later than Saturday, the 25th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Hall, Dewsbury,
May 14, 1895.

BOROUGH OF DEWSBURY.

THE Lighting and Water Committee of the above Corporation invite TENDERS for the supply and delivery during the Twelve Months ending the 31st day of August, 1896, of

(1) SULPHURIC ACID.
(2) WET AND DRY METERS.
(3) CAST-IRON GAS AND WATER PIPES.

Specifications and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Charles A. Craven, Gas-Works, Savile Town, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes," as the case may be, to be sent to me not later than Saturday, the 25th inst.

The Corporation do not bind themselves to accept he lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Hall, Dewsbury,
May 14, 1895.

MORLEY GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Morley Gas Com- pany invite TENDERS for the supply of about 8000 Tons of best GAS COAL, well screened, dressed, and free from Shale and Pyrites, to be delivered at the Gas-Works, Morley, or in Trucks at the Morley (L. & N.W.) Station, in such quantities and at such times as may be required during the Year ending June 30, 1896.

The Directors reserve the right to divide the quantity into two or more Contracts, as they may think fit, and do not bind themselves to accept the lowest or any tender.

Terms: Cash payments monthly.

Further Particulars may be obtained from the undersigned, to whom tenders, endorsed "Tender for Coal," must be sent not later than Wednesday, the 5th of June.

H. J. HEMINGWAY,
Secretary.

Gas Office, Morley, near Leeds,
May 18, 1895.

THE INCORPORATED

Gas Institute.

THE THIRTY-SECOND

ANNUAL GENERAL MEETING

OF THE MEMBERS

WILL BE HELD ON

Tuesday, Wednesday, and Thursday,

the 11th, 12th, and 13th of June, 1895,

AT THE

QUEEN STREET HALL,
EDINBURGH.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,

ROBERT MITCHELL, Esq.

On Friday, there will be a Trip to the Firth of Clyde and Loch Lomond. Full particulars will be announced on the Programme.

THE BENEVOLENT FUND.

The Annual General Meeting of the Donors and Subscribers to the Benevolent Fund will be held on Tuesday, June 11, at 5 o'clock p.m.

FREDK. G. BURFIELD, Secretary.

13, Victoria Street, Westminster, S.W.

TAR AND LIQUOR.

THE Gas Committee of the Borough of Congleton are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR, to be produced at their Gas-Works from July 1, 1895, to June 30, 1896.

Further Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tar and Liquor," addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Wednesday, June 5.

WM. ORME,
Manager.

BOROUGH OF CONGLETON.

THE Gas Committee invite Tenders for the supply of 3000 Tons of best screened GAS COAL, 3000 Tons of BURGY, and 500 Tons of best screened CANNEL, to be delivered between the 1st of July, 1895, and the 30th of June, 1896.

Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Wednesday, June 5.

WM. ORME,
Manager.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply of 4500 Tons of the best screened GAS COAL, to be delivered during the Year ending June, 1896.

Sealed tenders to be sent in to the Chairman of the Gas Committee, endorsed "Tender for Coal," not later than the 31st inst.

The Committee do not bind themselves to accept the lowest or any tender.

Any further Particulars may be had from the undersigned.

J. B. FENWICK,
Manager.

Gas and Water Office, Retford,
May 17, 1895.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Year ending June, 1896.

Tenders to be sent in to the Chairman of the Gas Committee, endorsed "Tender for Tar" or "Liquor," on or before the 31st inst.

Any further Information may be had from the undersigned.

J. B. FENWICK,
Manager.

Gas and Water Office, Retford,
May 17, 1895.

BRIDGNORTH CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee are prepared to receive sealed TENDERS for the supply of GAS COAL, including Carriage to the Bridgnorth Railway Station, as follows:—

(1) For One, Two, or Three Years, determinable, at the option of the Gas Committee, at the end of the First or Second Year.
(2) For One Year only.

Evidence as to the quality of the Coal must accompany each tender.

Quantity required: About 2000 tons per annum, in proportionate deliveries as directed—say, 70 per cent. during Winter Months, and 30 per cent. during Summer Months.

The Contract to commence at the end of July.

Sealed and marked tenders must be sent to the undersigned not later than Saturday, the 8th of June.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
J. H. COOKSEY, Town Clerk,
Secretary.

Bridgnorth,
May 25, 1895.

TENDERS FOR GAS COALS.

THE Directors of the Exmouth Gas Company are prepared to receive TENDERS for the supply of 2500 Tons of Screened or Unscreened Fresh-Wrought GAS COALS.

Tenders to be for price f.o.b. and c.i.f., at Exmouth Docks, between the 1st of July next and the 30th of June, 1896, accompanied by Working Analysis.

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Coal," to be sent in not later than the 1st day of June, 1895.

The Directors do not pledge themselves to accept the lowest or any Tender.

By order,
JAMES T. FOSTER,
Secretary.

Gas-Works, Exmouth,
May 9, 1895.

CORPORATION OF LEICESTER.

COAL TENDERS.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply of COALS, COBBLES, or NUTS (about 120,000 Tons per annum), for One, Two, or Three Years ending May 31.

Particulars and Form of Tender can be obtained on application to the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, the 8th of June next.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, May 15, 1895.

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR COAL, TAR, AND AMMONIACAL LIQUOR.

COAL—The Gas Committee of the above District Council are prepared to receive TENDERS for the supply of 2800 Tons of well-screened GAS COAL, to be free from Shale and Pyrites, and to be delivered at the Town Station, Sutton, in such quantities as the Manager shall from time to time direct between July 1, 1895, and June 30, 1896.

TAR AND LIQUOR—TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1895, to June 30, 1896.

Tenders, stating price per ton of 20 cwt. at the Works or at Sutton Town Station.

Tenders, endorsed, to be addressed to the Chairman of the Gas Committee, District Council Offices, Sutton-in-Ashfield, so as to arrive not later than the 4th day of June, 1895.

Particulars and other Information may be obtained from Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield.

By order,
G. H. HIBBERT,
Clerk to the Committee.

District Council Offices,
Sutton-in-Ashfield, Notts.,
May 16, 1895.

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.
(WATER DEPARTMENT.)

SUPPLY OF COAL.

THE Water Committee of the above District Council are prepared to receive TENDERS for the supply of 600 Tons of best HARD COAL SCREENINGS, to be delivered at the Mansfield Railway Station, or at their Pumping-Station at Rushley, Nottingham Road, in such quantities as the Manager shall from time to time direct, between July 1, 1895, to June 30, 1896.

Particulars and other Information may be obtained from Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, endorsed "Coal Screenings," to be addressed to the Chairman of the Water Committee, District Council Offices, Sutton-in-Ashfield, so as to arrive not later than Tuesday, the 4th day of June, 1895.

By order,
G. H. HIBBERT,
Clerk to the Committee.

District Council Offices,
Sutton-in-Ashfield, Notts.,
May 16, 1895.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 23,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 10th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 9, 1895.

NEEDHAM MARKET GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Needham Market Gas Company are prepared to receive TENDERS for the supply of 170 Tons of best GAS COAL, to be delivered at Needham Market Station in such quantities as may be required during the Twelve Months ending June 30, 1896.

Tenders, specifying the name of Coal to be supplied, to be delivered to me on or before June 1, 1895.

MYLES GILBERT,
Secretary.

Needham Market,
May 18, 1895.

TIVERTON CORPORATION.

TENDERS FOR COAL.

THE Lighting Committee are prepared to receive TENDERS for GAS COAL, required at the Tiverton Gas-Works for One, Two, or Three Years.

Further Particulars and Form of Tender may be obtained on application to the undersigned.

Sealed tenders, addressed to Mr. C. M. Hole, Town Clerk, and endorsed "Tender for Gas Coal," must be sent in on or before the 8th day of June next.

WM. LITTLEWOOD
Manager.

Gas-Works, Tiverton,
May 17, 1895.

TENDERS FOR GAS COAL.

THE Directors of the Cheltenham Gas-light and Coke Company are prepared to receive TENDERS for the supply of GAS COAL for Twelve Months from the 1st day of August next.

Full Particulars may be obtained from the undersigned, to whom tenders must be delivered on or before Thursday, the 6th day of June next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
R. O. PATERSON,
Engineer and Manager.

Gas-Works, Cheltenham,
May 15, 1895.

LEIGH URBAN DISTRICT COUNCIL.

THE Gas Committee of the Leigh Urban District Council invite TENDERS for the supply of GAS COAL or NUTS for a period of One Year, commencing on the 1st of July next.

The quantity required is 10,000 Tons.

Specification, with Tender Form and all Particulars, may be obtained from the undersigned.

Sealed tenders, endorsed "Coal," and addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leigh, not later than Monday, the 10th of June next.

The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
May 27, 1895.

BOROUGH OF NEWBURY.
(GAS DEPARTMENT.)

THE Gas Committee of the Borough of Newbury are open to receive TENDERS for the supply of 2800 Tons of best GAS COAL during the Year ending July 31, 1896, to be delivered in such quantities as may from time to time be required.

The price is to include delivery to Newbury Station (G.W.R.); and the Committee do not bind themselves to accept the lowest or any tender.

Tenders, addressed to the Chairman, Gas Offices, Newbury, are to be delivered by the 4th prox.

ROBERT M. COUPER,
Manager.

Gas-Works, Newbury,
May 25, 1895.

THE URBAN DISTRICT COUNCIL OF HAVERHILL.

TENDERS FOR COAL.

THE Council invite Tenders for the supply of 1200 Tons of the best screened GAS COAL, to be delivered free at Haverhill Station during the period of One Year from the 15th day of June next.

Delivery will be taken from time to time as the Manager shall require same.

The Council reserve the right to divide the Contract into two of 600 Tons each.

Tenders, in sealed envelopes, endorsed "Tender for Coal," should be addressed and sent to me, the undersigned, not later than the 4th day of June next.

By order,
SIDNEY H. GRAHAM,
Clerk to the Council.

Haverhill, May 16, 1895.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the supply for One, Two, or Three Years, of about 14,000 Tons per year (or such other quantity as may be agreed on) of best approved GAS COALS.

Tenders to state the price of the Coals, and the freight to Dartmouth or Torquay, separately and together, and also for delivery into the Company's Works, adjoining the Great Western Railway, free of all charges.

Payment by cash for freight on delivery, and by three months' Bills for the Coals.

Further Particulars to be obtained from Mr. Beynon, the Manager of the Company, Hollacombe, Paignton; and tenders to be sent to the undersigned on or before the 8th of June next.

Forms of Tender to be obtained from the Manager on payment of a fee of 10s. 6d., returnable on receipt of a *bonâ-fide* tender.

JOHN KITSON,
Secretary.

Torquay, May 20, 1895.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of about 16,000 Tons of screened or unscreened GAS COALS, and about 4000 Tons of CANNEL, to be delivered at their Works in Carlisle in such quantities as may be directed, from the 1st of July next.

Tenders, specifying the description of the Coal or Cannel, the Pits at which they are to be raised, and the Terms for net monthly payment, are to be sent on or before the 4th of June, 1895, endorsed "Tender for Coal."

Forms of Tender to be had from

C. B. NEWTON,
Engineer.

Gas-Works, Carlisle,
May 22, 1895.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the whole or part of 9500 Tons of the Best Screened GAS COALS and 2500 Tons of CANNEL, to be delivered free at Macclesfield, at such times and in such quantities as shall be ordered. Deliveries to commence on the 1st of August, 1895, and to be completed within a year.

Forms of Tender and Conditions may be had on application to the Engineer, Gas-Works, Macclesfield.

Tenders, sealed and endorsed, to be sent in not later than Saturday, the 8th day of June, 1895, addressed to the Chairman, Gas Committee, Town Hall, Macclesfield.

The Committee do not pledge themselves to accept the lowest or any tender.

W. FREDK. TAYLOR,
Town Clerk.

May 13, 1895.

THE Middleton Corporation are prepared to receive TENDERS for the supply of GAS COAL, delivered, at the Middleton Railway Station, in such quantities and at such times as the Corporation or their Gas Manager may require.

Tenders, addressed to the Chairman of the Gas Committee, must be delivered at my Office on or before Wednesday, the 19th of June, 1895, and be endorsed "Tender for Coal."

The Corporation do not bind themselves to accept the lowest or any tender.

Further Particulars and Form of Tender may be obtained by written application only to Mr. Duxbury, Gas Manager.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton, near Manchester,
May 22, 1895.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive TENDERS for the COAL and CANNEL required at their Works during a period of One or Two Years.

Forms of Tender may be obtained on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Coal," and addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me before Three p.m., on Thursday, the 13th of June, 1895.

By order,
SAML. BROWN,
Town Clerk.

Town Hall, Salford,
May 20, 1895.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Corporation invite TENDERS for the supply of 23,000 Tons of screened GAS COAL and NUTS, to be delivered during a period commencing the 1st of July, 1895, and terminating the 30th of June, 1896.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 10th of June next.

The Committee do not bind themselves to accept the lowest or any tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
May 22, 1895.

UXBRIDGE & HILLINGDON GAS CONSUMERS' COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 3500 Tons of GAS COAL, deliveries of which are to commence the first week of July, 1895, and finish the last week in May, 1896.

Tenders to be made out for 1000 Tons of best South Yorkshire unscreened Silkstone Gas Coal, delivered in Trucks (free) at Uxbridge Railway Station, G.W.R., each ton to contain 20 cwt., and 2500 Tons of the best description of unscreened Gas Coal from the Durham Coal-Fields, delivered by Barge (free) alongside the Company's Works, Grand Junction Canal.

Tenders are to state the names of the Pits from which the above description of Coal will be supplied; the same to be fresh wrought, and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.

Deliveries to be according to the requirements of the Company.

Tenders to be received on or before the 10th day of June next, addressed to the Chairman, Gas Company's Offices, Uxbridge, Middlesex, and endorsed "Tender for Coal."

A Form of Tender will be sent on application.

W. & W. M. GARDINER,
Secretaries.

Uxbridge, Middlesex,
May 22, 1895.

TENDERS FOR COAL.

THE Directors of the Town of Dudley Gaslight Company are prepared to receive TENDERS for the supply of 12,000 Tons of GAS COAL, to be delivered at the London and North-Western Railway or Great Western Railway Sidings, Dudley, in such quantities as may be required from the 1st of July, 1895, to the 30th of June, 1896.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Coal," to be sent in not later than the 4th of June.

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to divide the contract between two or more firms.

By order,
T. E. STILLARD,
Secretary.

Gas-Works, Dudley,
May 22, 1895.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of about 20,000 Tons of CANNEL, and about 230,000 Tons of best GAS COALS (Screened or Nuts).

Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required.

The Contract to commence July 1 next, and terminate June 30, 1896.

Forms of Tender may be obtained on application to Mr. R. H. Townsley, General Superintendent Gas Department, Municipal Buildings, Calverley Street.

Tenders may be for any portion of the total quantity required, and will be received not later than Wednesday, the 19th of June next, addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."

The lowest or any tender will not necessarily be accepted.

THE Gas Committee of the Leeds Corporation solicit TENDERS for the supply of the following ARTICLES, for Twelve Months ending the 30th of June, 1896:—

	Probable Quantity Required.
Best Merchant Iron, at per ton	about 25 Tons
Do. Sheet do., at per ton	„ 5 Tons
Bright Tin Charcoal Iron, at per cwt.	„ 10 Cwt.
Wrought-Iron Grate Bars, at per cwt.	„ 15 Tons
Steel, at per lb.	„ 20 Cwt.
Washers, of various sizes, at per gross	„ 250 Gross
Wrought Nails, at per stone	„ 100 Stones
Cut do., at per stone	„ 50 Stones
Gas Hooks, of various sizes, at per gross	„ 150 Gross
Pipe do. „ „ at per stone	„ 50 Stones
Bolts and Nuts, of various sizes	„ 5 Tons
Iron Rivets, at per stone	„ 160 Stones
Tin 1x, 1xx, xxx, Dxxxx, Doubles at per box	„ 40 Boxes
Tin Ingots, at per lb.	„ 10 Cwt.
Copper Bar, at per lb.	„ 150 Lbs.
Screws of various sizes, for Wood and Iron (discount off price list to be stated)	„ 90 Gross
No. 2 Square Ballast Shovels, at per doz.	„ 12 Doz.
No. 7 „ Coal „ at per doz.	„ 70 Doz.
Cast Steel Charging Shovels, at per doz.	„ 70 Doz.
Coke Forks, at per dozen	„ 12 Doz.
Spades, at per dozen	„ 3 Doz.
Shovel-Shafts, at per dozen	„ 2 Doz.
Pick-Shafts, at per dozen	„ 30 Doz.
Hammer-Shafts, at per dozen	„ 40 Doz.
Picks, at per lb.	„ 6 Doz.
Hammer-Heads, of various sizes, at per lb.	„ 12 Doz.
Rake-Heads, at per cwt.	„ 24 Doz.
Files of various sizes, and Re-cutting Files (discount off price list to be stated)	„ 11 Gross
Trowels, at per dozen	„ 20 Doz.
Galvanized Iron Buckets at per dozen	„ 40 Doz.
Weed Brooms, Scavenging, at per doz.	„ 50 Doz.
Brushes of various descriptions (net price).	
Besoms, at per dozen	„ 60 Doz.
India-rubber Goods (net price).	
Wood Plugs, from ⅜ in. to 24 in.	
Best New Pig Lead, at per ton	„ 20 Tons
Sheet Lead, at per ton	„ 20 Cwt.
Composition and Lead Tube, at per ton	„ 15 Tons
Best White Lead, Walker Parker's No. 1, at per cwt.	„ 6 Tons
Best White Lead, Walker Parker's No. 3, at per cwt.	
Best Red Lead, Walker Parker's (best), at per cwt.	„ 10 Cwt.
Red Oxide of Iron Paint, in Stiff Paste, per cwt.	„ 30 Cwt.
Good, Fine Ground Oil Paints, of various colours, in Stiff Paste, at per cwt.	„ 5 Cwt.
Red Oxide Varnish	„ 100 Gallons
Oak Varnish	„ 40 Gallons
Engine Oil, at per gallon	„ 1200 Gallons
Common Oil, at per gallon	„ 600 Gallons
Boiled Linseed Oil, at per gallon	„ 250 Gallons
Raw Linseed Oil, at per gallon	„ 100 Gallons
Neatsfoot Oil, at per gallon	„ 50 Gallons
Colza Oil, at per gallon	„ 80 Gallons
Turpentine, at per cwt.	„ 1 Ton
Best Refined Engine Tallow, at per cwt.	„ 60 Cwt.
Locomotive Grease, at per cwt.	„ 10 Cwt.
Sponge Cloths, at per gross	„ 5 Gross
Cotton Waste (coloured), at per cwt.	„ 100 Cwt.
Tarred Gaskin, at per cwt.	„ 150 Cwt.
Portland Cement, at per ton	„ 20 Tons
Soft Soap	„ 30 Firkins
Engine Packing, at per lb.	„ 500 Lbs.

All Articles to be delivered at the Stores, Dewsbury Road, or at the Gas-Works, at the price tendered.

Samples of the various Articles may be seen at the Stores Office, Dewsbury Road, and Forms of Tender obtained on application to Mr. R. H. Townsley, General Superintendent, Gas Department, Municipal Offices, Calverley Street.

Tenders will be received, addressed to the Chairman of the Committee, Municipal Offices, Calverley Street, not later than Wednesday, the 19th of June next.

The Committee do not bind themselves to accept the lowest or any tender.

BOROUGH OF WARRINGTON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply of 17,000 Tons of COAL.

Further Particulars and Form of Tender can be obtained on application to Mr. W. S. Haddock, Engineer, Gas-Works.

Sealed tenders, endorsed, and addressed to the Chairman of the Gas Committee, Gas Offices, must be sent in by Ten a.m. on Thursday, June 13 prox.

FREDK. TAYLOR.

Gas Offices, Warrington,
May 27, 1895.

LONGWOOD GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Year ending June 30, 1896.

Price per ton for Liquor per degree at 5° and 6° Twaddel. The estimated quantity for disposal is about 1600 Tons.

Tenders, sealed and endorsed, to be sent in not later than Tuesday, June 18, 1895, addressed to Edward Armitage, Esq., J.P., Chairman, Longwood Gas Company, Longwood, Huddersfield.

JOHN L. MITTON,
Manager and Secretary.

BOROUGH OF HUDDERSFIELD.

GAS COAL.

THE Gas Committee of the Huddersfield Corporation are prepared to receive TENDERS from Colliery Proprietors only, for the supply and delivery of about 50,000 Tons of best quality unscreened, fresh wrought GAS COAL.

Form of Tender and full Particulars may be obtained on application to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield.

Sealed tenders, endorsed "Tender for Coal," to be addressed and sent to him, not later than Tuesday, the 18th of June, 1895.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield,
May 24, 1895.

CHERTSEY GAS CONSUMERS' COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of between 3000 and 4000 Tons of best DURHAM GAS COAL, to be delivered (free) at Chertsey Railway Station during One Year from the 24th of June next, in the monthly quantities specified in tender.

Forms of Tender may be obtained on application to the undersigned.

Sealed tenders, specifying the name of Coal, to be sent to the undersigned not later than Five o'clock p.m. of Tuesday, the 11th of June prox.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
JOHN MOIR,
Secretary.

Chertsey, May 25, 1895.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 12,800 Tons of Screened GAS COALS, and about 700 Tons of good English CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during One, Two, or Three Years, commencing July 1, 1895.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 22nd day of June, 1895.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 20, 1895.

SCARBOROUGH GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR to be produced at their Works for One or more Years from the 1st day of July next.

Tenders for Liquor may be submitted either at a fixed price per ton or on a sliding scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned, to whom sealed tenders (duly endorsed) must be delivered not later than Noon, on Saturday, the 15th day of June next.

The Directors do not bind themselves to accept the highest or any tender.

By order of the Board,
(Signed) J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough,
Scarborough, May 17, 1895.

SEAFORD GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 600 Tons and upwards of best screened GAS COAL, to be delivered free at Seaford Station during Twelve Months from the date of accepting tender, at such times as may be required, in quantities of not less than Ten Trucks.

Tenders to be sent to the undersigned, with the Analysis of the Coal to be supplied, not later than June 7.

The Directors do not bind themselves to accept the lowest or any tender.

JAMES COWNEY,
Secretary.

Seaford, May 23, 1895.

SELBY URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Selby Urban District Council are prepared to receive TENDERS, on or before Noon on Tuesday, the 4th of June next, for 2300 Tons of high-class GAS COAL, delivered free into the Gas-Works Siding at Selby, in such quantities as may be required for a period of One Year, commencing the 1st of July next.

Particulars and printed Forms of Tender may be obtained, on application (in writing only), from the undersigned, to whom tenders, duly endorsed "Tender for Coal," must also be addressed.

The lowest or any tender not necessarily accepted.

By order,
MATT. DUNN,
Engineer and Manager.

Gas-Works, Selby,
May 8, 1895.

NEW MILLS GAS-WORKS.

THE Gas Committee of the New Mills Urban District Council invite TENDERS for the construction and erection of:—

(1) A GASHOLDER, 61 feet diameter by 20 feet deep, prepared for Telescoping; also GAS WASHER, CENTRE-VALVE, and Two GOVERNORS, and the REMOVING and RE-ERECTING of certain APPARATUS and PIPES at the Gas-Works.

(2) A RETORT-BENCH of Two Settings of Seven Retorts, with all Ironwork complete.

Tenders for each contract to be separate, and endorsed "Contract No. 1" or "No. 2," as the case may be.

Plans and Specifications may be seen on application to the Engineer, Mr. E. Jones, Town Hall, New Mills.

Sealed tenders to be sent to me the undersigned not later than Saturday, June 8, 1895.

The Committee do not bind themselves to accept the lowest or any tender.

(Signed) JOSEPH POLLITT,
Clerk to the Council.

Town Hall, New Mills,
May 22, 1895.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 18th of June, 1895, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1895, and for the transaction of the General Business of the Company.

One of the Directors, Mr. John Orwell Phillips, will retire from office, but offers himself for re-election.

The Auditors, Mr. Robert Hesketh Jones and Mr. Thomas Guyatt, will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 4th of June until the day of the Meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 28, 1895.

By order of the Directors of the Lea Bridge District Gas Company, £4000 4 per cent. PERPETUAL DEBENTURE STOCK of this Company, to be created and issued under the Provisions of the Lea Bridge District Gas Act, 1878, and offering to Trustees and others an Investment of the highest class, for Sale by Auction by

MR. ALFRED RICHARDS, at the Mart, E.C., on Thursday, June 20, at Two o'clock precisely in lots.

Particulars of the SECRETARY of the Company, 3, JEFFREYS SQUARE, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ILFORD GAS COMPANY.

DESIRABLE INVESTMENTS.

By order of the Board of Directors of the Ilford Gaslight and Coke Company, Limited.

MR. ASHMOLE will Sell by Auction, at the Angel Hotel, Ilford, on Thursday, June 6, 1895, at Five for Six o'clock p.m., 800 "B" SHARES of the nominal value of £5 each in the above old-established and flourishing Company.

Particulars and Conditions of Sale may be obtained of the SECRETARY of the Company; or of WM. ASHMOLE, F.A.I., Auctioneer, Surveyor, and Estate Agent, ILFORD.

COAL CONTRACT.

THE Directors of the Hexham Gas Company are prepared to receive TENDERS for the supply of about 2500 Tons of unscreened GAS COAL, delivered at Hexham Station as directed, during the Year ending June 30, 1896.

Tenders, with Analysis of Coal and Name of Pit at which it is raised, to be forwarded to the undersigned not later than the 6th of June.

HERBERT LEES,
Secretary and Manager.

Gas-Works, Hexham,
May 15, 1895.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS,

By N. H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

GAS PURIFICATION.

Best Absorbent of Sulphuretted Hydrogen, &c.

JAMES E. CAMPBELL,
Patentee and Manufacturer,
96, MILL STREET, BRADFORD, MANCHESTER.

PRICES, &c., ON APPLICATION.

"BEAR CREEK" CANNEL.

LOG MOUNTAIN COAL, COKE, AND TIMBER CO.,
PINEVILLE, KENTUCKY, U.S.A.
Cable Address: "Hull, Pineville."

LONDON AGENTS:
W. J. WILSON & Co., Suffolk House, Cannon St., E.C.

NOTICE.

The Incandescent Gas-Light Company, Limited, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

"The Incandescent Gas-Light Company, Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo,* **Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—**

"The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it, he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others,* **the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.**

(Signed) **FAITHFULL & OWEN,**
Solicitors for the Incandescent Gas Light Company, Limited.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

Winchester House, London, E.C. J. A. KELMAN.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

The LAW GUARANTEE & TRUST SOCIETY, LIMITED,

GUARANTEES FIDELITY.

Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.

HEAD OFFICE:

49, CHANCERY LANE, LONDON, W.C.

Limp Cloth; price 2s., free by post.

TABLES

FOR USE IN GAS OFFICES.

REPRINTED FROM

"Newbigging's Gas Manager's Handbook."

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

SELF-SEALING MOUTHPIECES

Made strong for Horizontal and Inclined Retorts in Round, Oval, and ⌂ shapes, and to open at Right Angles for Machine Work. Faced in Ruscoe's Patented Machines; thus ensuring correct and smooth joints when closed.

TESTIMONIALS.

Sheffield United Gaslight Company, Commercial Street, Sheffield, 11th April, 1895.

DEAR SIR,—In reply to your enquiry, I have pleasure in saying that we have a number of your Retort Mouthpieces at work, and that they give perfect satisfaction. Yours faithfully,

FLETCHER W. STEVENSON, Engineer.

Mr. JOHN RUSCOE.

Leigh Urban District Council, Gas & Water Departments, Leigh, Lancs., April 11th, 1895.

DEAR SIR,—In reply to yours of yesterday, I have pleasure in testifying that the Retort Mouthpieces which you supplied to the Leigh Gas-Works seven years ago have given every satisfaction. We have now 267 of the Mouthpieces erected, and hitherto none have required refacing. Yours faithfully,

Mr. J. RUSCOE, Albion Works, Hyde. A. T. FLETCHER.

FOR PARTICULARS APPLY TO JOHN RUSCOE, ALBION WORKS, HYDE.

CRIPPS' PATENT VALVE FOR BY-PASSING PURIFYING MATERIAL IN PURIFIERS.

The PRESIDENT OF THE INSTITUTION OF GAS ENGINEERS, in his Address, stated—

"To overcome back-pressure, Mr. F. S. Cripps has designed a special form of Valve fixed in conjunction with each layer in Purifiers, and operated from outside the vessel. By this means, any tier can be by-passed as it is fouled, and free access given to the superposed one."

This Valve enables Purifiers to last much longer, without the cost of changing, by permitting the Gas to pass by the Lower Tiers when exhausted, and entering the Upper Tiers only; thus doing away with the heavy Back-Pressure of the Lower Tiers, and fully using up the unexhausted Material in the Upper Tiers.

WILL SAVE THEIR COST IN SIX MONTHS. CAN BE FIXED TO PURIFIERS IN USE, AS WELL AS NEW PURIFIERS.

APPLY TO C. & W. WALKER,

Midland Iron-Works, Donnington, Shropshire; & 10, Finsbury Square, London.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past FOUR YEARS.

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is INSTANTANEOUS and PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS :—
Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES :—
Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—
Yield of Gas per ton . . 10,500 Cubic Feet.
Illuminating Power . . 16·9 Candles.
Coke . . . . . 66·7 Coke.
Sulphur . . . . . 0·86 Sulphur.
Ash . . . . . 2·04 Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

LOW MOOR BLACK BED GAS COAL.

YIELD OF GAS PER TON · 10,375 CUBIC FEET.
ILLUMINATING POWER · 17·50 SPERM CANDLES.
COKE · . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO.,
Central Plumbing Works, Town Hall Square,
BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.
Special attention to Repairs.
Improved Lead-Burning Machines, Sulphate Bagging Machines, Copper Scoops, &c.

HIGHEST REFERENCES ON APPLICATION.

ALFRED WILLIAMS & CO.

(MATTHEW MILDRED)
71, 72 & 73, BANKSIDE,
SOUTHWARK S.E.
UNIVERSAL PROVIDERS
FOR
GAS, WATER, & SEWAGE WORKS.
ENGINEERS & CONTRACTORS
FOR THE ERECTION OF COMPLETE GAS AND WATER WORKS, AND FOR RENEWALS AND EXTENSIONS OF EVERY DESCRIPTION.
PLANS & ESTIMATES ON APPLICATION.
MAIN LAYING AND RETORT SETTING.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T. B. KITTEL, SHEFFIELD.

TROTTER, HAINES, & CORBETT,

Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

HUNTER'S
OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.

IRONFOUNDERS,
MIDDLESBROUGH.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1). .	1·276
Weight of One Cubic Foot. .	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter.	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash.	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal .	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal . . .	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham, 8th August, 1894.

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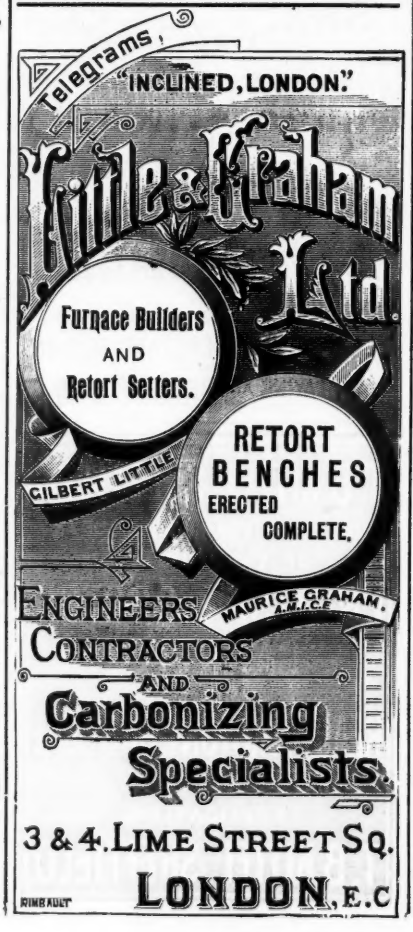

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Tudhoe Gas-Works,

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Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,

Yours truly,

A. B. COWAN,

Manager.

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Glasgow	300,000 ,,	Tottenham	600,000 ,,
Santiago	400,000 ,,		

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Belfast (Second Contract)	3,500,000 Cub. Ft.	Preston	1,500,000 Cub. Ft.
Brighton	1,250,000 ,,	Southport	750,000 ,,
Swansea	700,000 ,,	Manchester	3,000,000 ,,

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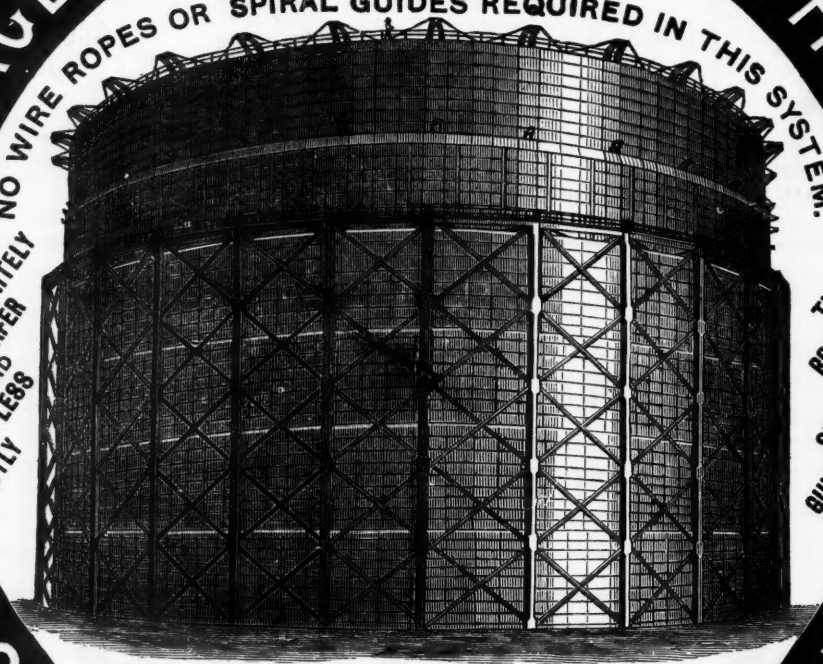

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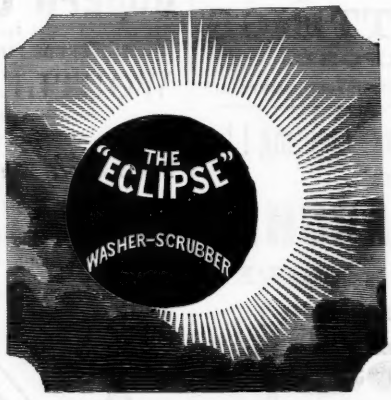

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